INTER AVIA

Review of World Aviation

In this Issue:

Quo vadis, Icarus ?— Air Crashes

Geoffrey Smith : Era of Rotary Power

Manhattan Project : The Atom Bomb in Retrospect

Convair-240 — Radar Navigational Aids — New Helicopters

Month in Review — F.A.I.

VOLUME II No 2 FEBRUARY, 1947

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Review of World Aviation

OFFICIAL ORGAN OF THE FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE (F. A. I.)

Volume II | February, 1947 | No. 2

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Front cover :
Bell Model 47 helicopter above Midtown Skyport, New York City

Appears Monthly in Four Editions : English, French, Spanish and German.
Publishing and Editorial Offices, Subscription Department : Interavia S. A., 20, Cité, Geneva.
Advertising Department : 13, Corraterie, Geneva. Telephones : 5.42.32, 5.42.33 and 5.42.34. Cables and Telegrams : Interavia-Geneva.

Prices: Switzerland : annual subscription, Sw. frs. 20.00; single copy, Sw. frs. 2.00. Annual subscriptions in other countries : U. S. A., $ 8.00; Great Britain, £ 2 0s 0d; France, Fr. frs. 1,000.00; Belgium, belg. frs. 350.00; Argentina, $ m/n 35.00; all other countries, Sw. frs. 30.00, single copy Sw. frs. 3.00.

Agents and Distributing Offices :

INTERAVIA U. S. A. :	292 Madison Avenue, Room 902, New York, N.Y.
INTERAVIA GREAT BRITAIN :	Eagle House, 109 Jermyn Street, London S. W. 1.
INTERAVIA IRELAND :	33 Kildare Street, Dublin.
INTERAVIA EGYPT :	B. P. 134, Cairo.
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INTERAVIA BRAZIL :	38 Rua Teofilo Otoni, Rio de Janeiro.
INTERAVIA ARGENTINA :	Charcas 2745, Buenos Aires.

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Printed in Switzerland
Imprimeries Populaires, Geneva — Héliographia S. A., Lausanne
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Extract from an address made by Mr. T. A. Macauley, Chairman of A. C. Cossor Ltd., on 14th August 1946, at the company's 8th General Meeting.

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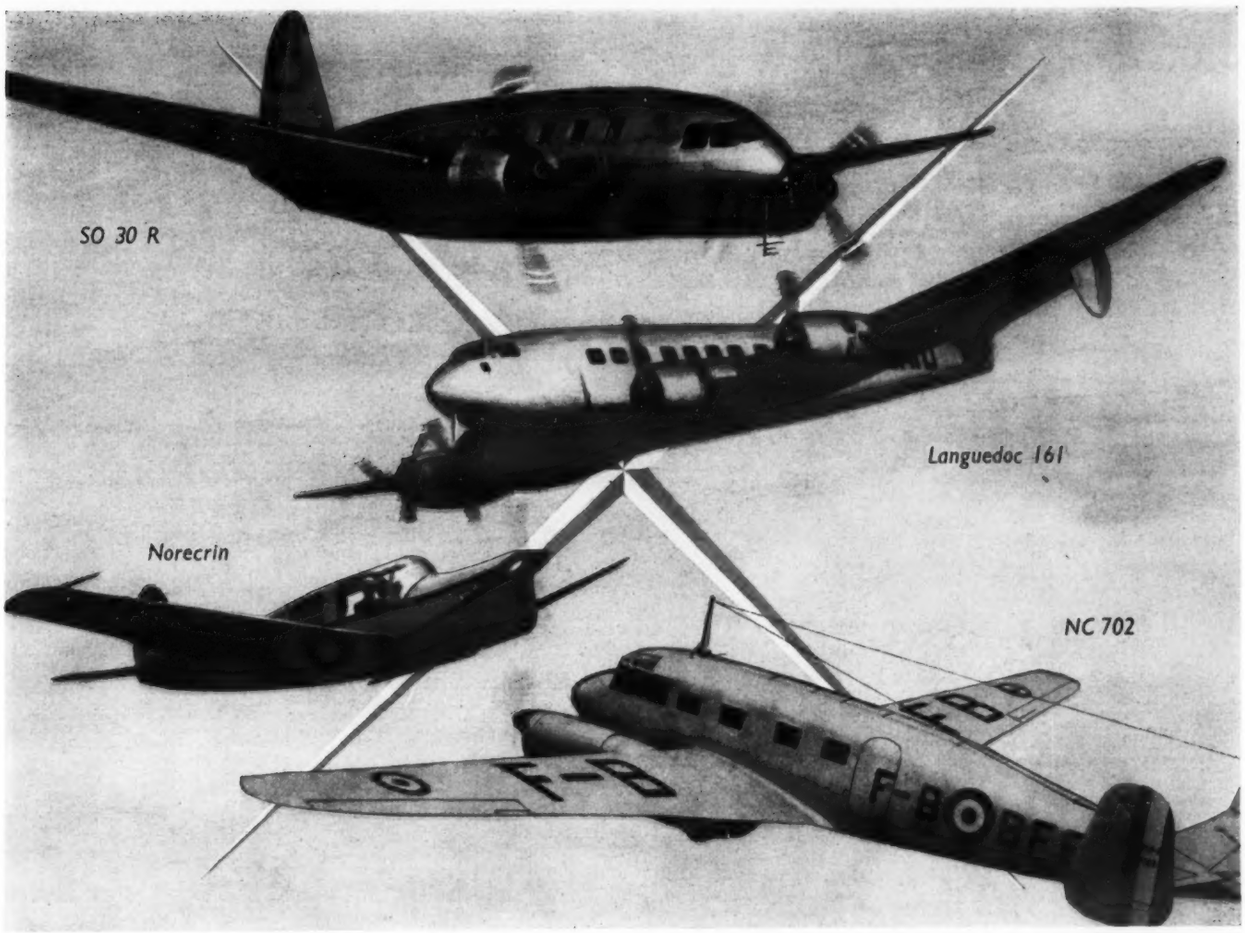

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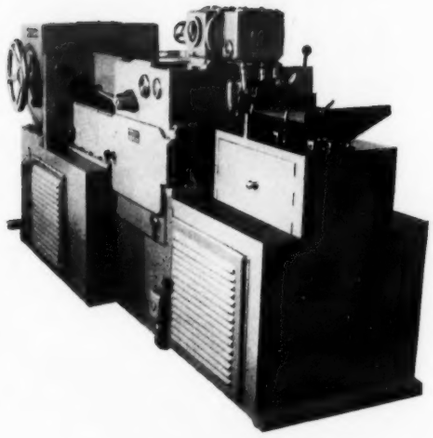

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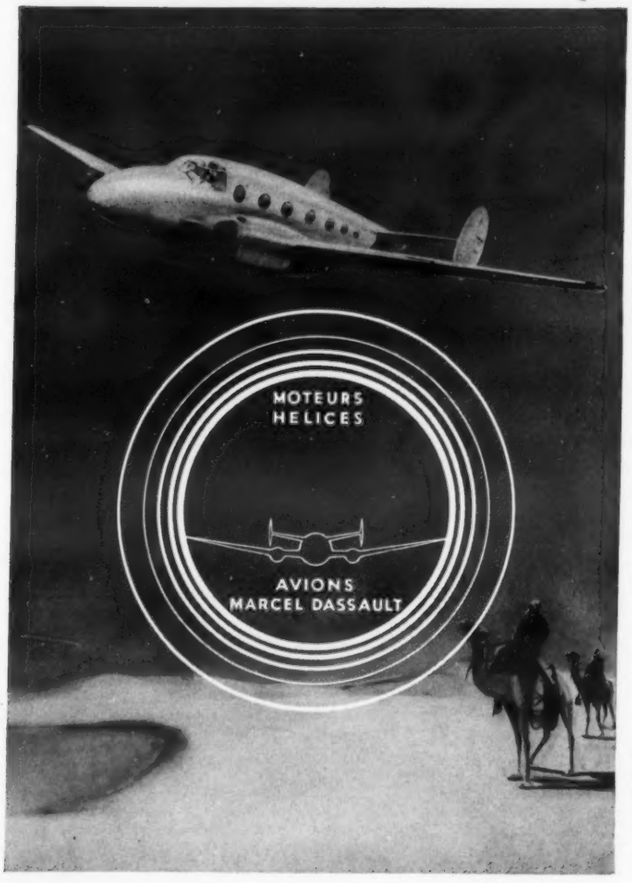

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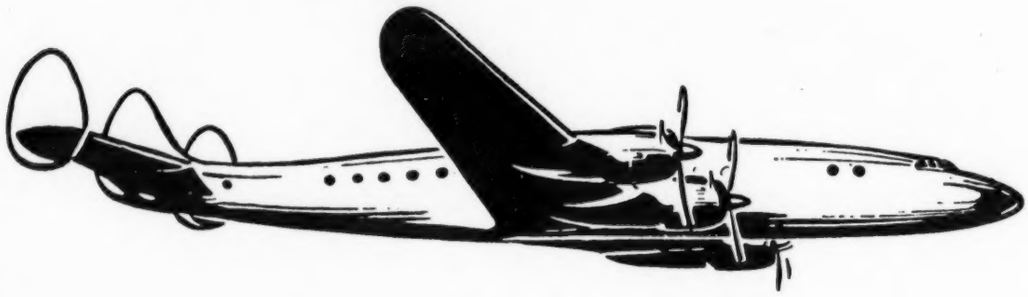

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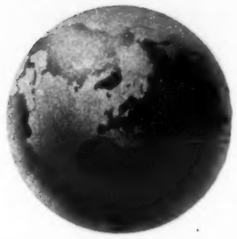


From Genoa to Moscow

Where is truth to be found, where does reality end and where does fantasy begin ?

As soon as someone talks or writes about Arctic bases — whether Iceland, Greenland, Spitzbergen or any other — statesmen suddenly become agitated. Americans and Russians crane their necks towards the North Pole to see what the other is doing in the way of firing-ramps for long-range projectiles . . . In the meantime, preparations are being made for the Foreign Ministers' Conference in Moscow, where the directives of a Peace Treaty with beaten Germany are to be established.

And now an *enfant terrible* arises, the American writer, W. B. Courtney, with a series of articles in " Collier's " at the end of January entitled " Will Russia Rule the Air ? " — It may be mentioned right away that he himself supplies the answer : Yes, and very definitely. — Where does reality end and fantasy begin ?

This is briefly what Courtney has to say : —

Three nations are in the race for command of the air. So far, the U.S.A. leads in air traffic, aircraft construction, trained personnel and industrial production. Great Britain leads in organised national research, in electronics and particularly radar, in new engine development and in the commercial drive to sell planes to foreign countries. But it is Russia who, without any warning fanfare of trumpets, has stolen the lead on all points of foresight, research and future war potentials, as well as in the realisation on former German scientific knowledge ; and this not in the sense of air power limited to warfare — not at all, but implying Air Power as significant and wide as the time-old Sea Power. These airfaring planners no longer speak of nations, but of continents ; and their eyes no longer fall along established trade routes, but on the shortest way linking — in commerce or war — the northern halves of the hemispheres. And this link is over the North Pole.

Granted, Mr. Courtney — all this is indisputable.

But today, whilst the Americans are conducting rocket tests in New Mexico and the British are trying out V-weapons in the Australian desert, and whilst both these nations are showing no hesitancy in giving refuge to the elite of German scientists, Courtney arrives at a surprising conclusion : in the solution of certain fundamental problems, including supersonic speed, pilotless guided weapons, rocket motors and fuels, Germany was probably 15 years ahead of the other countries at the beginning of 1945 ; restrictions on time and resources, not brains, defeated her.

With this, Courtney says he neither admires nor makes a plea for the police state method of unlimited financing of research ; but he cannot avoid admitting that foreign totalitarianism can only be combatted with the help of national policy and unity. He amplifies his meaning later on.

In this regard, Great Britain, the oldest, wisest and in commercial and diplomatic respects, the most formidable of the three competitors, he considers has dropped out as an ally. Russia, on the other hand, has the policy, unity, plan and, thanks to U. S. and German aid, the industrial capacity to make a race of it. A Soviet policy statement of August, 1946, is quoted : " . . . in the interest and the security of our people and other peace-loving countries, Soviet airplanes must fly higher, farther and faster than those of other countries . . . we must have the most powerful air force in the world ! ". And this, to an American, is scarcely less challenging than the old *Deutschland, Deutschland über alles !*

And then he draws clues from the 1946 Russian Budget, and points out that half the Soviet army is costing the Kremlin little as it is living off conquered and occupied lands between Korea and Austria ; reductions relative to the armed forces are counteracted by huge appropriations for industry and transportation, two fundamental factors for war. Allotments for scientific research total nearly $ 1,500,000,000.

The spotlight subsequently falls on the German research centres and factories which came under Russian rule on the terms of the Potsdam Agreement : from Peenemünde on the Baltic to Junkers and Siebel in Saxony. But the Heinkel and Arado branch works, and even dozens of other secret experimental stations, are left out. Meanwhile, however, the greatest " alchemy " works of all time, I. G. Farben at Bitterfeld — incidentally in Saxony also — suffices amply, even if many readers are not acquainted with its importance.

And what ought one to do about it ? Courtney is brief and to the point : In the use and application of the latest German secrets towards gaining mastery of the air, the Americans are seriously behind Russia and England. A great U. S. Air Force Research Centre of the Air Ocean should be founded if an unchallengable lead is to be won.

And everything summarised : " *German and Russian scientists have achieved what German and Russian politicians failed to achieve — alliance.* "

* * *

Memories are revived.

Twenty-five years ago, in April of 1922, one of the many post-war conferences of the time was held. It was a world economic conference, and it was the first time that representatives of a beaten Germany also sat round the table. Suddenly the question of Russia was raised, and a special committee was formed, to which Germany was not admitted. During the night something startling occurred : The German representatives, Wirth and Rathenau, and the Russian Foreign Minister, Krassin, had disappeared from Genoa. They had departed for lovely *Rapallo* and concluded an agreement which was to leave its imprint not only on German and Russian politics for many years, but on international politics in their entirety.

And already after Rapallo, German scientists began to leave for Russia. Already then, Junkers was building aircraft in the Soviet Union, German technicians were working in Russian research centres, and German pilots were flying aircraft of German design but under the Russian insignia. And already then, Germany was beaten, disarmed and politically insignificant. And already at that time, a thick curtain — perhaps not quite an iron one — hung between the West and the East.

In Genoa, Rathenau had concluded his first speech with imploring words from Dante's Divine Comedy : Peace ! Wendell L. Willkie was the last Western statesman to fly to Moscow and through the entire Eurasian area before Russia's entry into the last war, after which he expressed his thoughts in a book : " One World ! "

Both Rathenau and Willkie have departed from this earth. Where is the peace ? Where is the one, indivisible world ? Meanwhile, the air space is, and will remain, indivisible. E.E.H.

Quo vadis, Icarus?

Error, almost deception.

Can anybody be surprised ?

When the recent seven years of bloodshed came to an end, busybodies and more or less interested laymen spread a notion in which they seemed to believe.

For them flying suddenly became the A to Z of all transport. If you travelled by any other method, they made a laughing stock of you.

It had been instilled into the public's mind that the aeroplane was superior in speed, comfort, efficiency, regularity, and safety to any other form of transport. Railways were snubbed as being old-fashioned, and a voyage by boat was described as akin to the life of a galley slave. Pilots were portrayed as heroic " captains of the clouds " and air hostesses as the very personification of feminine charm, solely devoted to entertaining and pampering the passengers. Grandiose descriptions were given of how the airline companies lavished attention on travellers, how they were ushered into the aircraft, settled in comfortable arm-chairs, molly-coddled and spoon-fed all the way to their destination. A short journey in a comfortable limousine to the city centre ; you complete your business, and fly right back to your fireside. Cities and continents linked every few minutes... Heaven on Earth !

At the end of 1946 several hundred air travellers did indeed tread the Heavenly path — but in a way which caused air transport to suffer unpleasant repercussions : relatives in mourning, insurance companies having to pay, the travelling public bewildered ; and the formerly loud-mouthed, so-called publicity men were suddenly silent. It is well to understand what harm these people have done. Public opinion, always gullible, had first been promised the impossible ; then, in the form of sensational streamers about " airline disasters ", it had been given bigger pieces than it could chew. Mental fodder of this sort was not easy to digest ; and soon there was talk of a crisis in air transport.

All of us who are connected with aviation were under the spell of a sort of hallucination at the end of the war. Throughout the war we had read about and lived amongst aircraft roaring across the skies of the world by day and by night. We learned that these aircraft were taking off every few minutes to cross oceans, fly over cities, countryside and mountains, in fog and in darkness, locating targets in spite of heavy clouds, and, unless prevented by the enemy, returning safely to their home bases. We were told of gigantic airfields, enormous runways, radar and new instruments, new engines, new aircraft, radio direction-finding and blind-flying systems. The air lanes seemed to be wide open and unobstructed. And we all found ourselves believing that this was so.

In the space of a few years millions of men had become air-minded and had played an active part in aviation. Pilots could be counted in hundreds of thousands and were no longer the symbol of heroism, but just employees in one form of transport. To be a radio-operator, mechanic, airport manager, was to go about one's job like anyone else. Men, aircraft, instruments, installations — everything was there. The war was over, and air transport seemed only to have to pick the best and get to work.

That was how the newspapers portrayed things. The Air Age seemed to have arrived.

The Facts.

The following is a rough compilation of commercial airline accidents in 1946, upon which the daily press of all countries pounced with gleeful interest, to report them in gruesome detail. Add to it a brief enumeration of accidents in January, 1947, and the matter is clear. Truth is only dangerous when one evades it.

ACCIDENTS :

1946

January 6th : Douglas DC-3 of Pennsylvania-Central Airlines overshoots the boundary of the airport of Birmingham, Alabama, and comes to grief in a brook . . . . . 3 Dead, 5 Injured

January 18th : Douglas DC-3 of Eastern Airlines crashes near Cheshire, Connecticut . . 17 Dead

February 1st : Douglas DC-3 of United Air Lines crashes in the Elk Mountains . . . . 21 Dead

March 3rd : Douglas DC-3 of American Airlines crashes in mountains near San Diego . 23 Dead

March 5th : Junkers Ju 52 of C. S. A. makes an abortive instrument landing at Prague 10 Dead

March 10th : Australian Douglas DC-3 crashes in Tasmania . . . . . 21 Dead

April 1st : Avro " Anson " of Railway Air Services makes an abortive instrument landing at Belfast : 5 Dead

May 16th : Transport (type not disclosed) belonging to a U. S. charter company, Viking Air Transport, crashes near Richmont, U.S.A. . . . 5 Dead

May 22nd : Junkers Ju-52 of DNL crashes due to engine failure on take-off near Oslo. . 13 Dead

June 11th : Cessna twin-engined communications aircraft crashes, killing Dr. Samuel Bosch, Chief of the Argentine Aeronautics Secretariat 1 Dead

June 11th : Lockheed " Constellation " of TWA, used for crew training, catches fire over the airline's training base at Reading, Pennsylvania ; the Civil Aeronautics Adminstration grounds all " Constellations " for 30 days. . . . . 4 Dead

July 7th : Sikorsky S-51 helicopter crashes following rotor bearer sleeve failure . . . . . 4 Injured

August 5th : Douglas C-74 prototype crashes owing to wing failure . . . . . No Casualties

August 7th : Douglas DC-3 of BOAC crashes whilst attempting a forced landing due to weather conditions at the end of a special flight from London to Oslo . . . . . 2 Dead 10 Injured

August 21st : American " Landgraf " helicopter crashes due to rotor blade failure . . . . No Casualties

September 4th : Douglas DC-3 of Air France crashes after leaving Copenhagen, a broken fuel line having caught fire . . . . . 26 Dead

September 5th : Douglas DC-3 of Air France crashes due to engine failure on taking off from Paris : 20 Dead

September 5th : Douglas DC-3 of a US charter company, Translux Airlines, crashes from causes unknown whilst bound from New York for San Francisco . . . . . 23 Dead

September 7th : Avro "York" of British South American Airways, flying from London to Buenos Aires, develops engine trouble and crashes after taking off from Batnurst . . . . . 23 Dead

September 17th : Douglas DC-3 of Sabena, on night mail service to London, crashes due to engine failure on taking off from Brussels . . 1 Dead

September 19th : Douglas DC-4 of Sabena, en route from Brussels to New York, crashes in Newfoundland due to weather conditions. . . . 26 Dead

September : Douglas DC-3 of Panair do Brasil, bound from Bello Horizonte for Buenos Aires, crashes due to weather conditions . . 25 Dead

September 26th : De Havilland "Dragon Rapide" of Scottish Airways crashes whilst flying on instruments at the end of a flight from Islay to Glasgow : 7 Dead

September 27th : Handley Page "Halifax" of London Air Motor Services on a flight from Milan to London, makes an abortive forced landing on the beach at Knocke, Belgium. . . . . 1 Dead

October 3rd : Douglas DC-4 of American Overseas Airlines crashes in bad weather in Newfoundland shortly after taking-off for a trans-Atlantic flight 39 Dead

October : Douglas DC-4 of United Air Lines makes a forced landing . . . . . 2 Dead

October 7th : Douglas DC-4 of China National Aviation Corp. crashes in the mountains in Lololand and has not been found. . . . .

October 11th : Junkers Ju 52 of a French charter company, Air Océan, en route from Paris to Morocco, crashes in the Atlas Mountains : 16 Dead

October 12th : Douglas DC-4 of Eastern Airlines makes an abortive landing on instruments at Washington . . . . . No Casualties

October 17th : Douglas DC-3 of a U.S. charter company, National Transport Air Services, makes a forced landing in a snowstorm near Lamarie, U.S.A. . . . . 13 Dead

November 1st : Junkers Ju 52 of Languedoc-Roussillon, French private carrier, on a flight from Paris to Casablanca, crashes near Limoges . 24 Dead

November : Douglas DC-3 of KLM, flying from Amsterdam to London, makes a forced landing in bad weather near Guildford, Kent . . 4 Injured

November : Lockheed "Constellation" of KLM suffers a mishap when its undercarriage collapses whilst taxi-ing at Santa Maria Airport, Azores No Casualties

November 11th : Douglas DC-3 of United Airlines crashes on the outskirts of Cleveland after hitting a high tension cable with its undercarriage : 12 Dead, 16 Injured

November 12th : Douglas DC-3 of Western Airlines, en route from Salt Lake City to Los Angeles, crashes in bad weather . . . . . 11 Dead

November 13th : Douglas DC-3 of a Mexican air line crashes at Vera Cruz . . . . . 15 Dead

November : Unspecified type of aircraft belonging to the British firm of Airwork, Ltd., and chartered by the Shell concern for a mission to Ecuador, crashes in the Andes . . . . . 3 Dead

December 10th : Beechcraft twin-engined transport of the Egyptian Misr Airline crashes near Damascus : 3 Dead

December 17th : Unspecified type of aircraft of the Philippine Far Eastern Air Transport is lost : 12 Dead

December 23rd : Douglas DC-3 of Atlas Aviation Co., British non-scheduledcarrier, bound from London for Geneva, loses its way and makes a forced landing near Lyons. . . . . Some Injured

December 23rd : Avro "York" of the Argentine carrier, FAMA, makes an abortive landing in bad weather near Rio de Janeiro . . . . . 20 Dead

December 24th : Douglas DC-3 of Western Airlines crashes near San Diego during a night flight : 12 Dead

December 24th : 3 Chinese airliners (type not specified) crash near Shanghai in bad weather. . 70 Dead

December 28th : Unspecified aircraft (probably Douglas DC-3) of American Airlines, en route from Chicago to Buffalo, makes an emergency landing near Michigan City due to engine failure 2 Dead 20 Injured

December 28th : Lockheed "Constellation" of TWA makes an abortive night landing at Shannon whilst flying from Paris to New York. . . . 13 Dead

1947

January 5th : Douglas DC-4 of China National Aviation Corp. crashes shortly after taking off from Tsing Tao . . . . . 42 Dead

January 11th : Douglas DC-3 of BOAC, en route from London to Bordeaux, crashes due to lack of fuel ; the aircraft was returning to England after being unable to land at several French airfields because of bad weather . . . . . 5 Dead

January 12th : Douglas DC-3 of Eastern Air Lines, en route from Detroit to Miami, makes an abortive forced landing near Wythville in bad weather conditions. . . . . 18 Dead

January 12th : Aircraft (type not specified) of the Philippine carrier, Far Eastern Air Transport, crashes into the sea whilst flying from Shanghai to Hongkong . . . . . 6 Dead

January 23th : Douglas DC-3 of the Columbian carrier, Avianca, crashes ; believed to have struck a mountain . . . . . 17 Dead

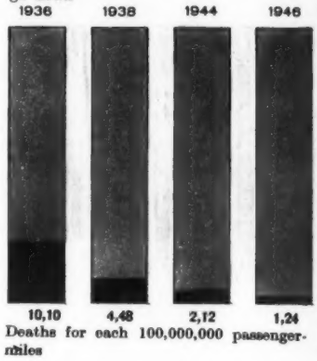
January 25th : Douglas DC-3 of a new South African charter company, Spencer Airways, crashes on taking off from Croydon, London, due to engine failure . . . . . 12 Dead

January 26th : Douglas DC-3 of KLM crashes after taking off from Copenhagen airport due to the elevator's being locked . . . . . 22 Dead

Jan. 25th-28th : Two Douglas DC-3's of China National Aviation Corp. are reported overdue : 44 Dead

Total : 48 accidents in 1946 with 622 killed ; 8 accidents in January, 1947, with 166 killed. *In the last thirteen months there were 56 accidents, incurring 788 deaths.*

The figures in this list, though not yet officially given, are nevertheless accurate to a reasonable degree. They represent a somewhat rudementary summary of the incidents that have affected the international civil air services and certain sections of non-scheduled operations. That this list is fairly correct and carefully compiled is evident from a comparison with the official accident statistics issued on January 14th, 1947, on U.S. domestic airline accidents : nine fatal accidents in 1946, entailing 97 passenger and crew fatalities ; our list contains the same number of fatal accidents, with only 92 persons killed, which is explained by the possibility that certain casualties died later of their injuries.



Year by year, American aviation has seen the percentage of fatal accidents go down
Deaths for each 100,000,000 passenger-miles

However, we should not allow ourselves to be impressed too easily by a mere enumeration of airline disasters. Figures are meaningless unless they involve a logical relation to some kind of performance : in 1945 the U.S. domestic air services recorded eight fatal accidents, and nine in 1946, in which 88 and 97 people, respectively, were killed. But during the same period the number of passenger miles rose from 3,554,700,000 to 6,045,600,000, i. e., by about 55 % within a year. Even more convincing proof of the fact that *airline safety is improving in spite of all reverses* is contained in the annual statistics of the U.S. Civil Aeronautics Administration : in 1936 there were 10.10 fatalities per 100,000,000 passenger miles ; by 1939 this figure had dropped to 4.48, by 1944 to 2.12, and by 1946 to 1.24.

This gives us reason for hope.

The causes.

A study of the causes of the majority of airline accidents in 1946 is indicated.

It is interesting to note that, compared with 1939, the basic causes have hardly changed. Bad weather and piloting errors still top the list ; in the American domestic

Weather conditions and piloting errors caused 48 % of air accidents in 1946.

field, for instance, piloting errors were responsible for 48 % of all accidents last year. The next group is composed of accidents caused by engine failure at the take-off and landing. Then follows the category due to deficiencies in ground organization, such as inadequate types or insufficient quantity of installations and equipment, and errors committed by the operating personnel. Finally, a few crashes were due to icing, which belong in the category of bad weather accidents ; a few cases of fire breaking out aboard aircraft ; and only a small number of instances which could be attributed to structural failure.

Exactly the same picture as was presented by the small pre-war field of aviation — except for a certain significant difference : frequencies, speeds and ranges have grown enormously !

This brings us to the *core of the whole evil.* Actually, it is not aviation itself that has let us down. The present feeling of disappointment is really due to the fact that the afore-mentioned prophets deceived a gullible public with eloquent stories about radar equipment, instrument flying and instrument landing in bad weather, unceasing trans-Atlantic air services and one hundred percent regularity and flying safety.

They deluded themselves and everyone else. Take, for instance, those two variable factors : nature and *homo sapiens* ; weather and aircrew. We can predict the weather within a certain margin of error, but we cannot change it ; all we can do is fly around it. We can also assume that airline flying personnel possesses a certain amount of knowledge, and we can assume certain relative reactions. But all these items do not form a constant with which we can reckon unconditionally. And as long as the variable factors, nature and man, cannot be paired with automatically-working equipment in the air and on the ground, with equipment operating with a maximum of reliability under human supervision, we cannot possibly talk about one hundred percent regularity and safety in commercial aviation. In this respect the aircraft is still inferior to earth-bound modes of transport.

Why deceive ourselves ? All this equipment, be it radar or modern radio systems, electric altimeters or automatic anti-icing installations, it is still only under development, or at the most in the test stage. By no means has it yet been universally adopted by international commercial air services.

The situation is entangled in the plurality of national frontiers, of languages, measurements and weights. An American pilot flying over or into a Central European country can reckon on nothing better than morse telegraphy, but never with two-way radio telephony. Far away from his country of origin he finds that in place of Anglo-Saxon pounds and tons he has to use Central European kilogrammes ; and that in place of miles and knots, kilometres are required. Until the time when uniform world-wide regulation brings order into these matters, it will be difficult for ground and air crews to collaborate with the fullest confidence. This mixture of languages and jumble of arithmetic with which the pilots flying the international air lanes have to contend necessarily contains an element of danger as soon as the captain of an aircraft finds himself in an emergency and has to make a quick decision.

Were the sacrifices in vain ?

When the accident curve of the winter of 1946-47 began to rise steeply around the turn of the year, voices were suddenly raised all over the world. In America, Congress demanded an account from the Civil Aeronautics Board, but it was brought home to

T. P. Wright, United States Civil Aeronautics Administrator.

members of the Senate and House of Representatives that they themselves had to bear part of the blame. For instance, the Civil Aeronautics Administration had requested $ 92,000,000 for the 1945-46 fiscal year to improve air safety, but this figure was cut to $ 64,000,000. It had demanded $ 114,000,000 for the current fiscal year, but received appropriations of only $ 92,000,000. CAA pointed out that it had to close down 55 air communications stations and 3 airport control towers owing to lack of funds. And it recalled that the Army Air Forces and the Naval Air Services carried out a total of nearly 54,000 radar-controlled blind landings, but that such equipment was still in the wishful thinking stage as far as the commercial air. services are concerned.

Improbable as it may sound, it is nevertheless undeniable that *during the war air safety was sponsored officially, whilst in time of peace it is being neglected.*

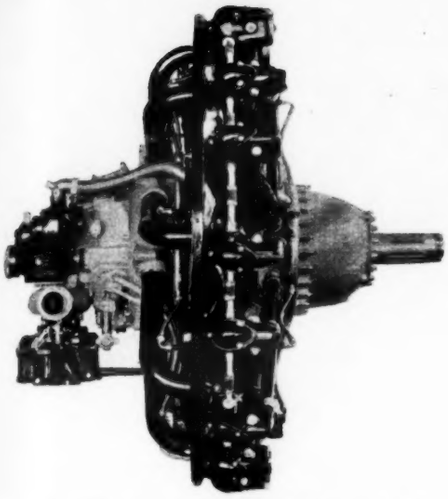
The U.S. Army and Navy assisted in the development of two systems, both of which gave rise to great hopes : Ground-Controlled Approach (GCA) and Instrument Landing System (ILS), designated SCS 51 by the Army.

GCA is a combination between a radar screen on which the ground station can locate the position of the aircraft, and two-way radio. The aircraft is effectively " talked-down " by the airport personnel. This was practicable during the war as long as American air bases all over the world were manned by American personnel. Today ? What language should an American aircrew use in its communications with the ground crew at Rome, or how is a French crew going to make itself understood to the personnel at Washington ? In Esperanto ? — The second landing aid developed in the U.S.A. during the war is nothing but an improvement and perfection of the beacon system known before the war : a transmitter and marker beacon, permitting the aeroplane to follow a pre-determined approach path to the point of touch-down. The Civil Aeronautics Administration proposes to build 70 ILS installations at a cost of $ 175,000 each by April, 1947, but it is by no means certain that the necessary receiving equipment, costing $ 1,500 an aircraft, will be made available to the airlines by that date. For the time being American industry seems to prefer concentrating on the more profitable manufacture of refrigerators and automobile accessories.

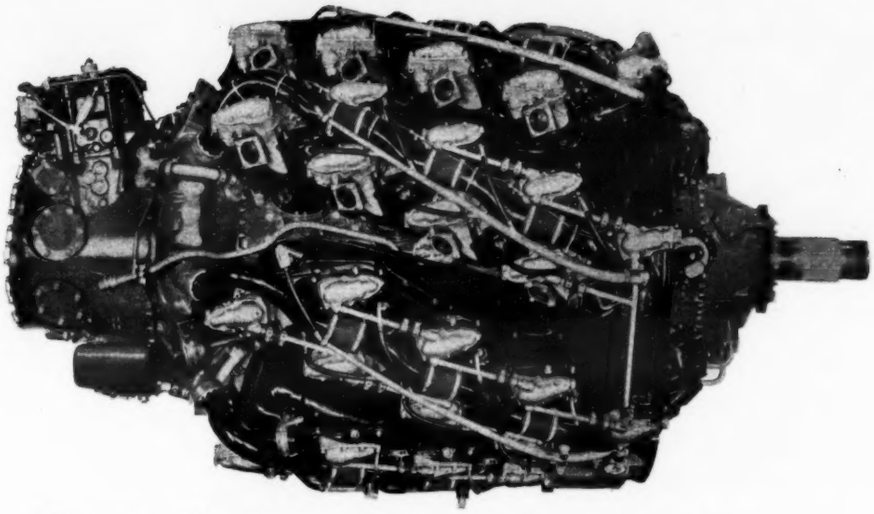
What about that order in the air, Gentlemen of the Senate ? Until that order is established, all-weather flying must remain in Utopia.

Closely related to this is the lack of uniform standards in ground organization. But somehow this question is invariably glossed over. Building runways of a specified length and strength in accordance with rules established by the Provisional International Civil Aviation Organization is a mere beginning. Without suitable radio aids, the aircraft, crew and passengers are at the mercy of incidents of all kinds at take-off and landing. But should these facilities one day be designed after a uniform pattern, and placed at the focal points of the commercial air services, they would still require the engagement and training of an adequate number of technical personnel to operate them day and night. During the war men in uniform manned these stations, and the Government provided the funds. In peace time ? Governments and municipalities have but one obscession : reduce the budget ; save money. And then the public demands information concerning air safety.

Let us go a step further and consider the subject of engine failures which can lead to abortive take-offs and emergency landings. Statistics reveal that engine trouble still occurs, even though the maximum performance of aero engines has been improved greatly, as a result of which cruising loads on power plant could be reduced considerably. Meanwhile, we cannot avoid the fact that the air carrier has an interest and an obligation to operate his equipment — aircraft and engines — as economically as possible. During the



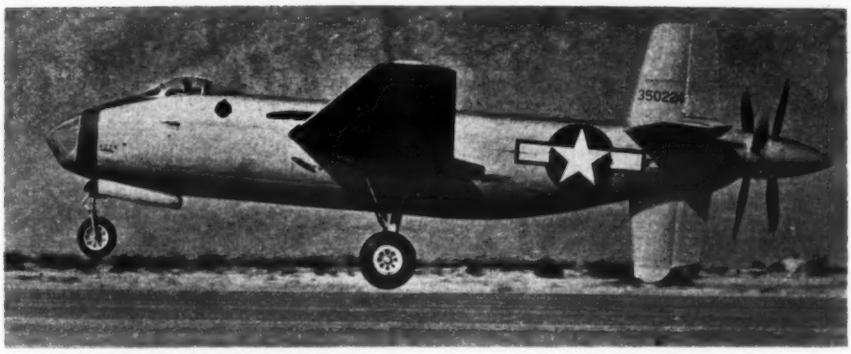
A 1930 power plant : Pratt & Whitney " Hornet " 9-cylinder radial of 800 H. P.



A 1946 power plant : Pratt & Whitney " Double Wasp " 28-cylinder four-row radial of 3,600 H. P.

war it was found that the take-off weight of transport aircraft in service with military units could be exceeded without jeopardising operational safety to any great extent. Now that the same aeroplanes are at the disposal of commercial operators, it seems almost unreasonable to demand that a private enterprise forego an additional source of revenue and voluntarily revert to the gross weight limits applicable before the war. A business is obviously disinclined to cut payload when engine performance has been increased. As a result, there is a squabble as to which is the admissible take-off gross weight of a Douglas DC-3. And this notwithstanding the fact that the type is standard equipment of which more than 10,000 units have been built. But it is all the same obsolescent . . .

New twin-engined types are topping the horizon, and Consolidated Vultee or Glenn L. Martin, for instance, are conducting an intensive advertising campaign for their products. But in the light of recent results the question arises of whether these new twin-engined transports really represent an advance, if they really are the *dernier cri* of the new air age.



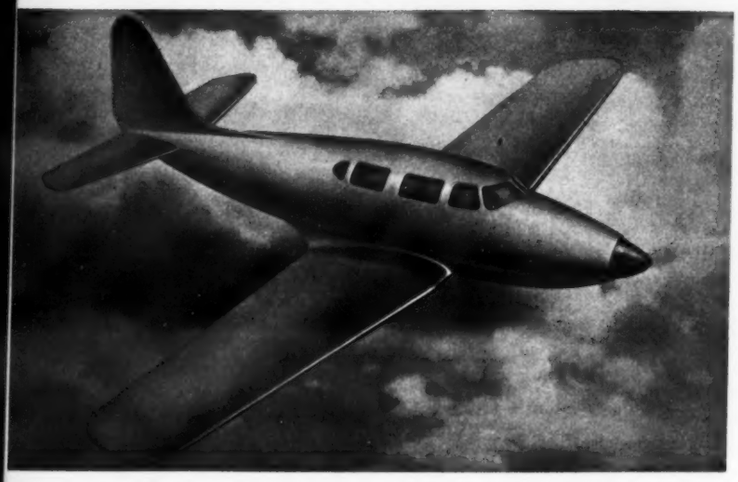
Douglas XB-42 " Mixmaster " with two Allison engines.

One engine to each wing half ? Has aeronautical design remained stationary ?

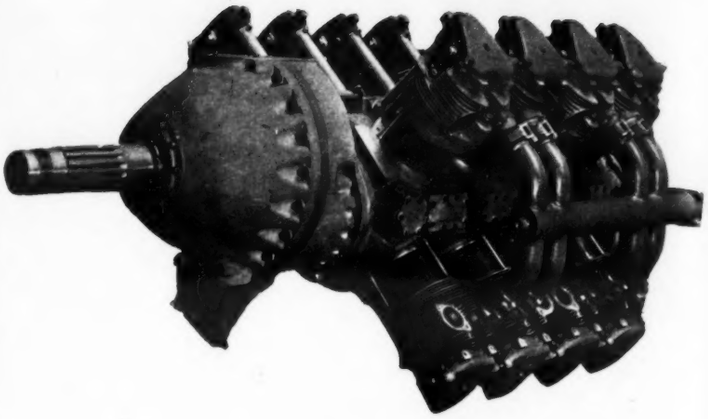
It was in the early thirties that the first engines of relatively high power became available and the twin-engined design adopted to replace the old three-engined machines. Engine powers rose, and operators were forced to put up with the circumstance that in the case of one engine's failing the thrust became unsymmetric and seriously affected the stability of the aircraft. It was probably these considerations that drove designers to improve flying equipment : before the war, Lockheed made an attempt in this direction by building the Vega-Unitwin, a small airliner carrying two coupled engines in the nose ; towards the end of the war Douglas pursued a similar idea with the " Mixmaster ", development of which was meanwhile shelved after the prototype crashed during tests. But, as the new Douglas " Cloudster " touring aircraft shows, Douglas has not altogether abandoned this development trend. And, at the recent Paris Aero Show, SNCA

Martin 2-0-2 commercial transport.

Two Menasco engines driving a single airscrew.



SNCN du Sud-Ouest SO 7010 light commercial transport with Mathis G16 R engine.



Mathis G16 R 16-cylinder engine of 394 H. P.

du Sud-Ouest exhibited the SO 7010 personal aircraft, powered by two engines housed in fuselage, and showed that French research is also seeking new ways and means.

* * *

It strikes one as odd that designers all over the world fail to demonstrate greater initiative and enthusiasm in serving their clients and the safety of the airlines. The aircraft industry is still spoiled by war-time quantity production. But maybe the day is not so far off when it will be only too pleased to concentrate all its efforts on participating in design competitions organized by individual airline companies or, perhaps, by the International Air Transport Association.

These are all problems which today preoccupy the men engaged in aviation, no matter whether they are in Government or international positions, in the executive offices of the airlines, or in the cockpits of the airliners. But it is these worries which constitute the embryon of that ideal programme for the future ; and the U.S. Civil Aeronautics Administration has already established minimum air safety requirements for the new flying equipment, requirements which are expected to be met by 1951.

A long-term change — for what is supposed to happen between now and 1951 !

As a reader puts it sarcastically : " . . . Recent events have shown, in any case, what dangerous monster, under the name of international aviation, has been let loose against humanity. And no Government on earth has the courage . . . " Very temperamental, but not to be taken very seriously. — More significant seems to be the introductory sentence to a brief report on the recent air safety discussions in " Time " magazine of January 27th : " The only perfectly safe airplane is one on the ground, with engines stopped, fuel tanks purged. "

This type of irony tells ! Unfortunately it does not hit the guilty. It does not hit the prophets that promised the impossible, nor those Government men who draft air legislation and curtail aviation appropriations in time of peace. No ! The attacks are unjustly directed against those very people whose only wish is to remedy the situation : the men of aviation themselves.

Flying as never before !

What is going to happen next ? Accidents will always happen, the same as railway, road and shipping accidents have always happened. Transportation will continue to claim victims, and even more so as speeds increase and traffic volume rises. But what can be attained and what will have to be attained is a reduction of accidents to a minimum.

As long as air transportation is obliged to operate in the present circumstances, with aircraft built during the war and on the point of becoming obsolete, and with inadequate facilities and installations, it will go through a period of transition requiring self-imposed restrictions. It is fortunate that the airline companies are headed neither by adventurers nor by dunderheads. But experts are all the same not magicians. At the same time they have to consider the moral and material welfare of their companies, simultaneously watching the safety of their operations and the earning capacity of the money entrusted to their care.

After the last world war the principle was established that air transportation was a fully-developed mode of conveyance, a self-supporting trade free of any Government subsidy. True, the subsidising practices of pre-war years were exaggerated. But shipping, railroad and trucking companies are as a matter of course subsidised to a slight extent by Government, even though this fact is given no great publicity. Only where air transportation is concerned is there this tendency to go from one extreme to the other. The best thing would be for Governments to lay down their cards : maybe they are planning to nationalize commercial air services, to nationalize them all over the world ? There would be method in that at least.

By taking men and equipment over from the war, the illusion has so far been created that a sound basis has been laid for a perfect system of air transport. A " Dakota " aircraft which during the war failed on a mission whilst carrying supplies to a battle area was merely a victim of circumstances, and its occupants died heroes. But a " Dakota " or a DC-3 of 1947 may no longer fail because of avoidable circumstances ; its occupants have paid for the trip and take a poor view of a hero's death.

The war is over and radar and radio equipment which permitted the location of approaching enemy formations or of targets shrouded in fog and darkness should be stripped of the veil of military secrecy without further ado. These inventions belong to the commercial air services, they must be developed for the air travellers benefit, and they must be introduced throughout, if necessary with Government financial assistance. The taxpayer is tired of being fleeced for destruction and death only ; but he wouldn't have any objection to paying occasionally for progress and safety.

Those men who during the war flew night and day, and in every weather, must be taken

aside, trained for civil aviation, and sufficiently paid to allow for a decent existence.

Aircraft manufacturers who in the daily press exhort an unsuspecting public to " fly in this or that aircraft " — which is just the same as saying " don't fly in this or that aircraft " — are spreading a dangerous type of propaganda which may one day be thrown back in their faces. Since when has it become custom for a fare to ask a cabby the make of his vehicule ? He is entitled to assume that a cab unsuitable for the purpose would automatically be forbidden the road by the competent authorities. It should not be otherwise in aviation.

Transport by air cannot be compared to rail transport, where locomotive and engineer are changed at a frontier. Air transportation is international — or else it just isn't air transportation. Aircraft fly across the seas to foreign countries, and in those countries they simply must encounter uniform safety measures which inspire confidence in the aircrews and are intelligible to them.

International organisations, be they PICAO IATA or FAI, are incessantly endeavouring to help aviation by publishing decisions and memoranda. But their efforts are worthless as long as Government officials just sit back, letting documents pile up on their desks, and content themselves with giving things their consideration.

A dangerous monster — an aircraft is safe only on the ground ?

There is every indication of this attitude's spreading. At the end of 1946 the U.S. " Saturday Evening Post " ran a poll amongst people who had never travelled by air. Of those questioned, 49.5 percent replied that they had never had the opportunity, or else that they were not interested. This class of traveller seems to be lost to the airlines for reasons about which little can be done. But 43.8 percent confessed that they were scared to fly. These can be converted and won for the airlines.

To achieve this aim, improved aircraft, instruments and procedures must be developed. But why only in 1951 ? It is not necessary to appeal to the authorities. A little goodwill, a little international collaboration, and once in a while Government aid, even if the war is over.

And then — flying as never before ! *E.E.H.*

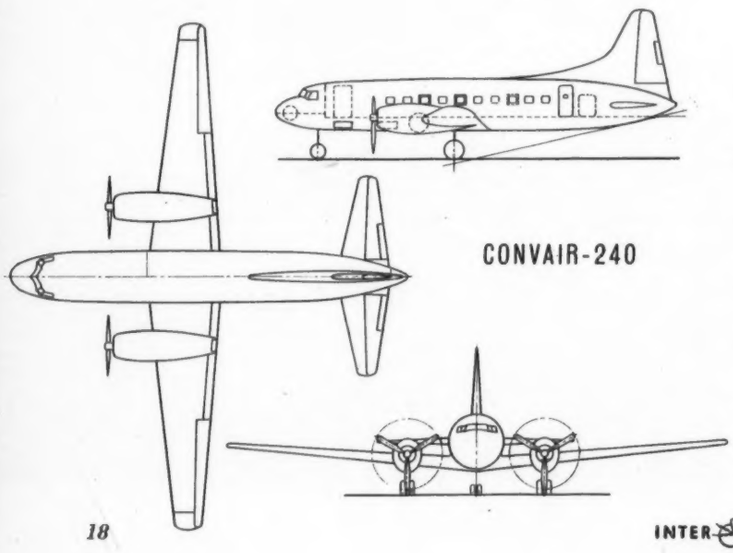
CONVAIR-240

With the airline companies' new four-engined equipment at the forefront, one tends to forget that the major portion of all twin-engined commercial aircraft for medium and short-line operations consists of more or less obselete types.

As a result of the recent series of much publicized crashes, the Douglas DC-3 and its "Dakota" military counterpart, converted on a large scale for passenger carriage since the war, have become the object of a wide-spread criticism which is likely to accelerate their replacement. It is not intended to examine here the justice or injustice of the accusations made against the DC-3. What is clear, however, is that the airlines of all countries are at present faced with the obligation to re-equip themselves with new twin-engined transports as soon as possible. This would present no particular problem if the aircraft industry already had something for sale which offered any pronounced advance over the DC-3.

The only comparable type which France can offer is the 30-passenger SO 30 R "Bellatrix" built by Société Nationale de Constructions Aéronautiques du Sud-Ouest (SNCASO), which, incidentally, was described in No. 5 (August, 1946) of "Interavia, Review of World Aviation". Great Britain's only contribution to this class is the Vickers "Viking" transport.

The situation is only slightly more favourable in the U.S.A. Douglas Aircraft Co. seems to shelved its medium-range pusher projects, and only two U.S. aircraft firms are present striving to provide a successor to the DC-3 : *The Glenn L. Martin Co.*, Baltimore, with its *Martin 202 and 303*, and *Consolidated Vultee Aircraft Corp.*, San Diego, with its new *Convair-240*.

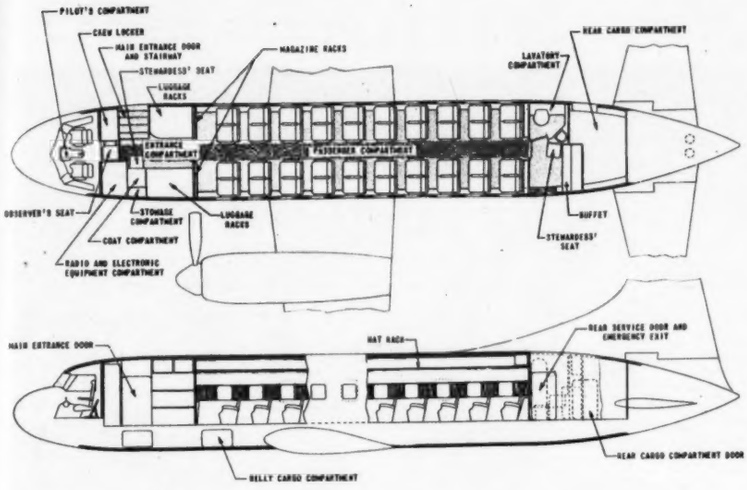


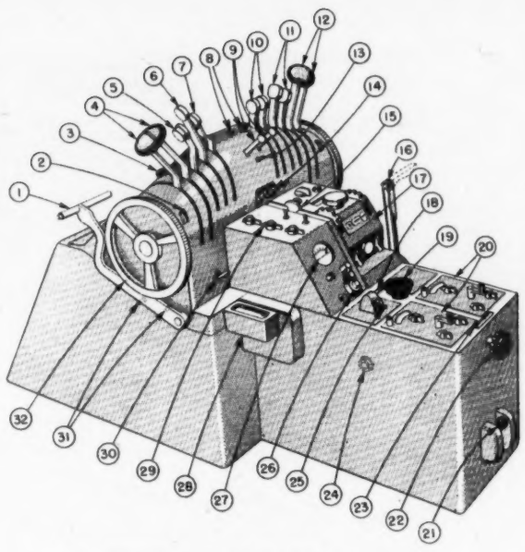
The moment is premature to draw up a comparison of the performance of these two aircraft, the first-mentioned of which did not take the air until November of last year. "Interavia, Review of World Aviation", No. 3 (June, 1946) contained a description of the Martin 202/303 as well as a list of the design performance data available at that time ; it is aimed in the following paragraphs to describe, as far as available documentation permits, the *Convair-240*.

Already the object of firm orders placed by four U.S. carriers, and KLM Royal Dutch Airlines, the Convair-240 is powered by two Pratt & Whitney R-2800-C air-cooled twin-row radials, each developing 2,100 H.P. at take-off and which can be stepped up to 2,300 H.P. if water injection is used. At maximum all-up weight of 39,500 lbs. and with a payload which, according to latest news, has been increased to 10,000 lbs., it is to attain a top speed of 341 m.p.h. at an output of 1,700 H.P. per engine at 13,500 ft. altitude. Civil Air Regulations stipulate a runway length for take-off of 3,800 ft., and a runway length for landing of 4,140 ft. at maximum landing weight of 37,619 lbs. With a normal fuel supply of 825 U.S. gals., which can be increased to 1,000 U.S. gals., the Convair-240 should reach a cruising speed of 300 m.p.h. and a range of 830 miles, taking into account a fuel reserve for a further 200 miles and an additional 3/4 hours, and a 10-m.p.h. headwind. Accommodating 40 passengers, the aircraft is thus in a position to replace the Douglas DC-3 for American and European medium-range operations.

The *structure* of the Convair-240 features no particularly conspicuous innovations. A cantilever low-wing monoplane with single fin and rudder unit and dual-wheel tricycle undercarriage, it embodies an all-metal stressed skin and stringer-type construction with normal structural use of steel and an extensive application of Alclad-alloy sheet stock.

The *fuselage* is circular in cross-section, of semi-monocoque construction, and is designed for pressurisation along the whole length. The pilots' compartment accommodates a pilot, a co-pilot and an observer, the latter's seat being aft of the control pedestal and arranged so as not to interfere with the controls at any time. Immediately aft thereof is the entrance compartment with the door to the left of the fuselage centre line instead of to the right, as is usually found. In order that passengers need not deposite their light luggage in cargo holds which are inaccessible during flight, ample bag racks are provided on either side of the passage into the passenger cabin. — Incidentally,





PILOT'S CONTROL PEDESTAL

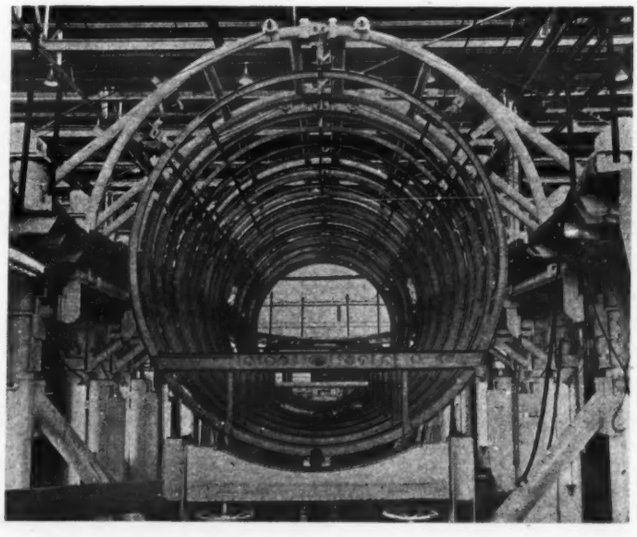
1. Control gust lock.
2. Elevator trim tab position indicator.
3. Windshield wiper control.
4. Pilot's throttles.
5. Rudder auto-pilot control.
6. Aileron auto-pilot control.
7. Elevator auto-pilot control.
8. Propeller limit warning indicator lights.
9. Electric propeller pitch control.
10. Carburettor alternative air door control.
11. Mixture control.
12. Co-pilot's throttles.
13. Water injection.
14. Blower shift switches.
15. Emergency hydraulic pump switch.
16. Landing gear control.
17. Auto-pilot control unit.
18. Rudder trim tab position indicator.
19. Rudder trim tab control.
20. ADF tuning units.
21. Hydraulic by-pass valve.
22. Aileron trim tab control.
23. Aileron trim tab position indicator.
24. Override-landing gear control handle down lock solenoid (R. H. Side of Pedestal).
25. Flap control switch.
26. Manual compass control panel.
27. ADF tuning meter.
28. Ash tray.
29. Volume control and frequency selector.
30. Override-propeller reversing solenoid.
31. Throttle warning switch release (R. H. Side of Pedestal).
32. Elevator trim tab control.

this may be regarded as a first step towards eliminating the present delays in loading and unloading light luggage ; in this way a passenger can carry his own bag aboard and does not have to wait for it at the terminal, as in the past. — The passenger cabin contains two rows of twenty seats on either side of a central aisle, and is followed by the lavatory, buffet and stewardess quarters. The rear part of the pressurized fuselage section forms a cargo compartment which is accessible through a door located on the right side of the aircraft. Adjacent to each pair of seats is a rectangular window of laminated plate glass, approximately 18 in. wide and 16 in. high. Except for the nose-wheel well, the entire fuselage enclosure is pressure-tight. Ice protection plating is installed on the fuselage in the propeller plane.

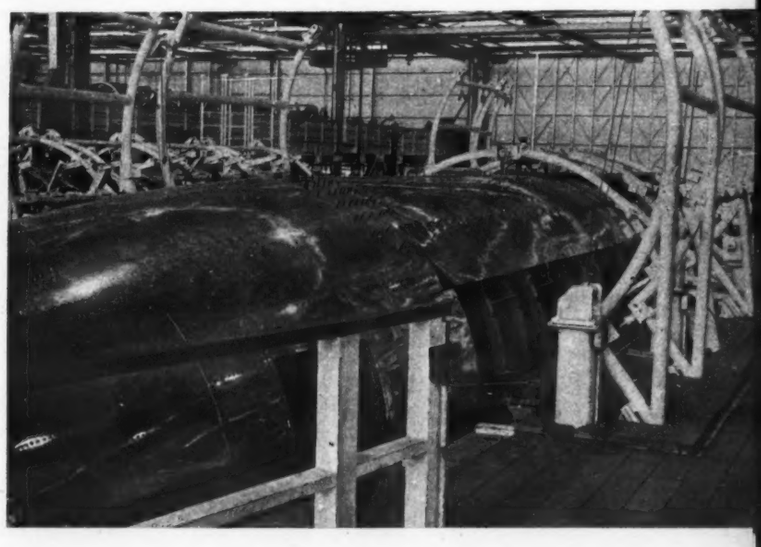
Forward of the propeller plane is the main entrance door, approximately 36 in. wide by 83 in. high, fitted with a self-contained stairway. This enables passengers at small airports to be embarked without the assistance of ground personnel. An optional location for the entrance door is beneath the tail, also fitted with a built-in stairway. A separate service door, about 30 in. wide and 65 in. high, is located on the rear left side. Access to the rear cargo compartment is provided by a corresponding door on the right side of the fuselage. Five emergency exits are installed inside the passenger cabin, which open inwards and are equipped with conspicuous inside and outside release handles.

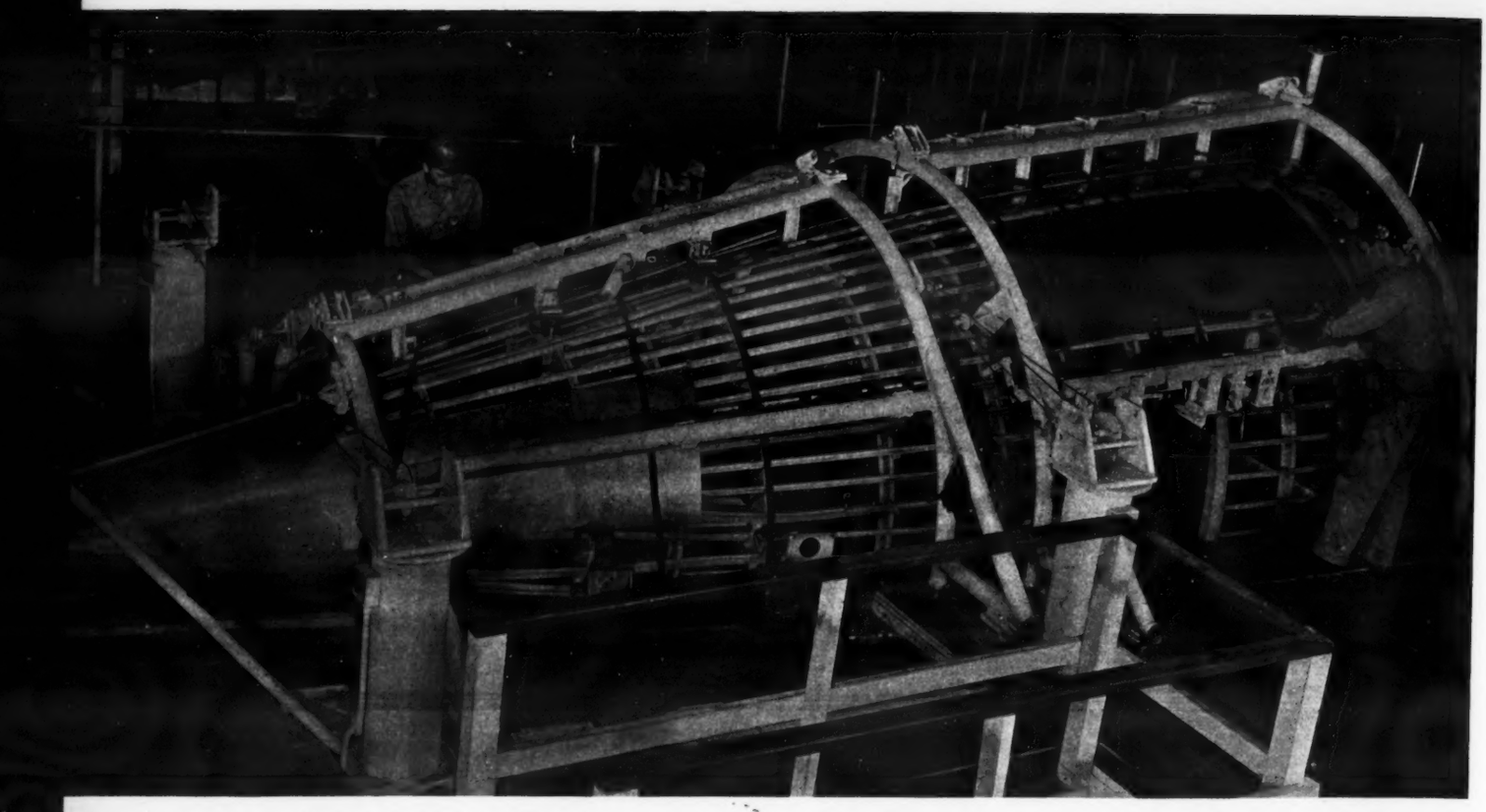
The *wing* structure is of cantilever box-type construction incorporating two spars. The centre section bears the two engine nacelles whilst the outer wing panels with the ailerons are detachable. The leading edge is of particular interest as it is detachable and constructed for heat anti-icing ; the sections between the nacelle and fuselage are attached to the front wing spar by hinges at the top to facilitate maintenance and inspection of the equipment located in that area. The centre section incorporates an integral fuel tank outboard of each nacelle between the front and rear spears, with the box construction of the wing forming the walls of the tanks. Fuel tanks are sealed

Circular transverse frames with floor supports, ready for assembly with the longitudinal stiffeners and fuselage skin.



Application of skin to fuselage frame.





Rear of Convair-240 prior to attachment of tail group.

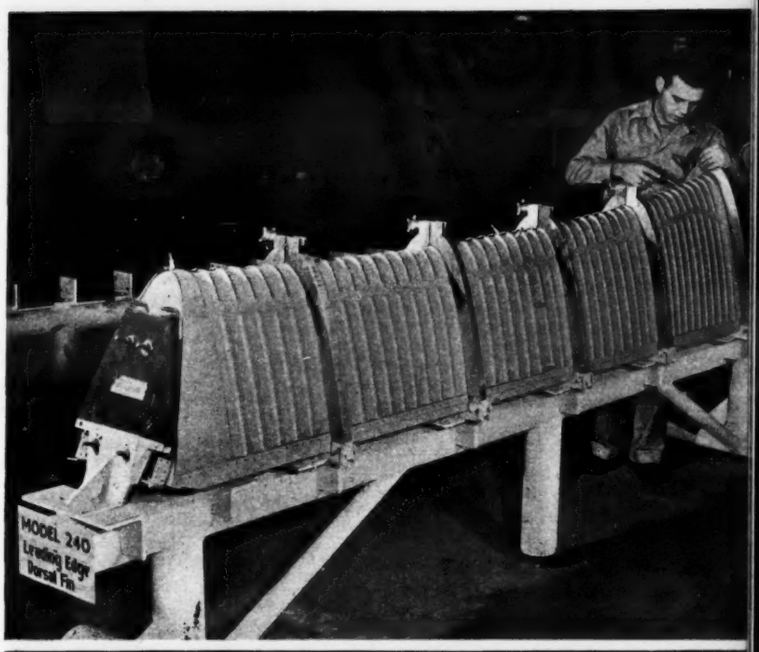
through the incorporation of 1/32-in. neoprene sheet in the external seams. The ailerons, of all-metal construction, are attached by means of hinge brackets installed on the rear wing spar, and aerodynamically and statically balanced. They carry mass-balanced flight tabs and trim tabs which are not mass balanced. The *Fowler-type wing flaps* are 26 ft. 8 in. long and extended to 40° for take-off and 30° for landing. They are attached to the rear wing spar by means of roller bearing carriage assemblies and are protected by an additional metal covering from excessive temperatures and corrosion in the engine exhaust region.

The tail group, including the rudder and trim tabs, is entirely of metal and, similar to the wing, is provided with thermal de-icing. The horizontal stabiliser has a span of 36.5 ft. and an area of 233 sq. ft. The elevators are rigidly interconnected, the left one carrying a trailing edge flight tab and the right one, an irreversible trailing edge trim tab, both being aerodynamically and statically balanced. The same details apply to the rudder which, together with the vertical stabiliser, has an area of 155 sq. ft. As in the case of the other control surfaces it likewise features a flight tab and a trim tab.

Wing construction outboard of nacelles ; photo shows application of neophene sealings in fuel tank region.

Nose construction.

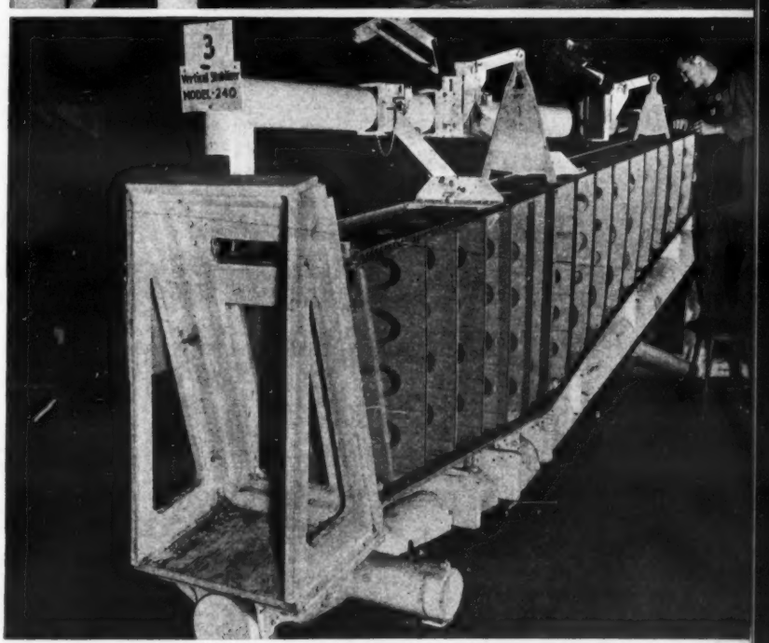
Double-walled leading edges in tailplane for circulation of hot anti-icing air. Photo shows leading edge of dorsal fin before attachment of skin.



The *tricycle landing gear* comprises two sets of dual-type main wheels retracting forwards into the nacelles, and a dual-type steerable nose-wheel. Retraction is operated hydraulically, but extension may be accomplished by using the drag and weight of the gear. C.A.R. require complete retraction within 6.5 at sec. a temperature of 32° F. at take-off speed and take-off engine rotative speed, and 13 sec. with one engine cut out. An additional safety device makes it impossible to retract the undercarriage as long as any weight remains upon it. The brakes are operated hydraulically from toe pedals on the rudder control pedals, an emergency air system also being provided. — The nose wheel, mounted on an oleo pneumatic shock strut, is steered by means of a wheel at the left of the pilots' cabin ; an indicator provides an accuracy of plus or minus 2°. Swivel is restricted to about 63° each side of neutral, which allows the aircraft to pivot about the centre of either main gear and, thanks to the reversible-pitch propellers, to be steered backwards. A quick disconnect is installed to permit 360° nose gear swivelling for ground handling.

The two Pratt & Whitney R-2800-C air-cooled twin-row radials form interchangeable *power units,* detachable at the firewall. Both engines provide for installation of a water injection system, whereby the water would be supplied under pressure by an electric pump from a 25-gallon tank. Pressure switches actuated by engine oil pressure prevent inadvertent pump operation when the engines are not running. Engine cooling air enters behind the propeller hub and is ejected together with the exhaust gases through two ducts running towards the rear end of the nacelle. These two ducts, whose flow is controlled by an electrically actuated outlet flap, function as an injection pump to draw cooling air across the engine. In addition, the heat energy in the exhaust gases and engine cooling air is utilized for additional thrust, which action is particularly effective at high speeds. Both ducts contain flush scoops to supply hot air for the anti-icing and cabin heating. — Carburettor air enters at the top of the nacelle and is led via an alternate air flap through a central duct to the carburettor. Oil cooling air enters below the engine, is trapped separately and ejected from beneath the nacelle. Each engine has its own oil system with a tank of 25 gallons capacity located directly aft of the fire wall. An electrically-actuated remote transmitter measures the quantity in the oil tank with the aid of a float mechanism, whilst the cooled oil returns to the tank through a thermostat flap control.

The two fuel tanks, each containing 500 gals., are located in the outer wing panels and can be connected either separately or together to one or both engines. It is specified that the fuel system should function satisfactorily at temperatures ranging from — 40° F. to + 110° F., and up to 20,000 ft. altitude without the use of booster pumps. Each tank has sufficient expansion space for a 25° F. rise above filling temperature. A vane-type fuel pump is mounted on each engine, supplemented by a auxiliary booster pump to each tank. The Hamilton Standard hydraulic controllable-pitch constant-speed, *three-blade propellers* can be set to feathering or braking position. Quick pitch-change to reverse angle is achieved with specially powerful pumps in the oil tanks. Reverse to positive pitch change is accomplished by pulling back the control column in the cockpit, whereby



In the middle : Wing centre section trailing edge. At right : Framework of vertical stabiliser.

Positioning fuselage on to wing centre section.

an electric valve impedes this action as long as no weight is on the undercarriage. Anti-icing is achieved with electrical resistance "boots" fitted to each blade.

The *hydraulic system* of the Convair-240 actuates the undercarriage, wheel brakes, nose-wheel steering mechanism, wing flaps, and the windshield wipers. Each engine drives a hydraulic pump, and one auxiliary, electrically-driven pump is provided for emergency operations.

Current is supplied to the *electrical system* by one generator to each engine, with a continuous capacity rating of 300 amperes at 30 volts. In addition, there are two 12-volt, 28-ampere/hour batteries, wired in series and connected to the system through a battery relay. Two

Assembly of fuselage and wing.

400-cycle, 115-volt, 3-phase AC inverters feed the radio equipment, auto-pilot and flight instruments.

The *radio equipment* includes : a medium high-frequency transmitter-receiver set, with the antenna extending from above the cockpit to the upper part of the vertical stabilizer leading edge ; a VHF transmitter-receiver set, with a short antenna rod located vertically on the bottom of the fuselage ; an automatic radio compass with two control panels installed on the pilots pedestal, and two loop antennae fixed beneath the fuselage nose ; a radio range receiver and a marker beacon receiver with common antenna beneath the fuselage ; localizer and glide path receiving equipment with two cross-pointer indicators and an antenna mounted above the cockpit ; and a radio altimeter, with the transmission and reception antennae situated in tandem on the bottom of the aircraft.

The *ice elimination system* of the Convair-240 works, as described above, with hot air warmed by the exhaust gases and led to the leading edges of the control surfaces. A duct leads from the nacelles towards the tail, where it separates into three ducts for warming the tail assembly's leading edges. The system provides an average of 1,500 BTU/sq. ft./hr. at 0° F. outside temperature and 10,000 ft. altitude, and can also operate satisfactorily on one engine. Air for heating, cooling and *ventilating* of the passenger cabin and pilots' compartment is supplied by the pressurization system primary compressor. The air cycle passes through two intercoolers, a secondary compressor, an expansion turbine and a water separator, with one of the intercoolers simultaneously serving as a heat exchanger between the hot exhaust gases and the fresh air. Compartment air passes through a central duct to the double side walls, and leaves by way of the cabin roof. The system provides 20 cu.ft./min. of air per passenger.

The compressor of the *pressurization system* is driven hydraulically from two piston-type pumps, one geared to each engine. A maximum pressure differential of 3.5 lb./sq. in. may be maintained between the cabin pressure and the atmosphere, whereas the fuselage structure is designed for an ultimate working pressure differential of 7.0 lb./sq.in. The compressor is capable of maintaining a flow of 52.7 lb./sq. in. per min. of ventilating air at an aircraft altitude of 15,000 ft. and a cabin altitude of 7,000 ft.

SPECIFICATIONS

MAIN DIMENSIONS

Span	91 ft. 9 in.
Length	74 ft. 8 in.
Height	26 ft. 11 in.

FUSELAGE

Max. diameter	9 ft. 11 in.
Volume of cabin	1651.19 cu. ft.
Volume of cockpit	139.70 cu. ft.
Volume of luggage stowage	142.0 cu. ft.
Volume of cargo hold (aft)	192.78 cu. ft.
Volume of cargo hold (below)	88.0 cu. ft.
Volume of lavatory	85.85 cu. ft.
Volume of buffet	135.09 cu. ft.
Volume of entrance	178.79 cu. ft.

WING GROUP

Wing area	817 sq. ft.
Root chord	13 ft. 6 in.
Tip chord	4 ft. 6 in.
Taper ratio	ca. 3 : 1
Root incidence	4°
Dihedral	4° 50'
Aspect ratio	10
Root airfoil	NACA 634120
30.7 % semispan airfoil	NACA 634419
Tip airfoil	NACA 634515

AILERONS

Total area	42 sq. ft.
Span (each)	17 ft. 6 in.

Convair-240 assembly line at Consolidated Vultee Aircraft Corp., San Diego.

Up-travel	20°
Down-travel	20°
Flight tab (up and down)	10°
Trim tab (up and down)	10°

FLAPS:

Total area	140 sq. ft.
Span (each)	26 ft. 8 in.
Max. movement	40°

TAIL GROUP

Horizontal surfaces:

Total area	233 sq. ft.
Span	36 ft. 5 in.
Elevator up-travel	25°
Elevator down-travel	15°
Flight tab up-travel	9°
Flight tab down-travel	15°
Trim tab up and down	10°

Vertical surfaces:

Total area	155 sq. ft.
Rudder l. and r. movement	18°
Flight tab l. and r.	12°
Trim tab l. and r.	9°

LANDING GEAR

Track	25 ft.
Wheel base	24 ft. 10 in.

POWER PLANT Pratt & Whitney R-2800-C

Take off with water injection at sea level	2400 H. P.
Take-off speed	2800 r. p. m.
Take-off power (normal)	2100 H. P.
Continuous power at 6000 ft. with low blower	1800 H. P.
With high blower at 13,500 ft.	1675 H. P.

PROPELLERS Hamilton Standard

Diameter	19 ft. 1 in.
Tip clearance from ground	12 in.
Tip clearance from fuselage	17 in.
Propeller gear ratio	1 : 0.45

WEIGHT DISTRIBUTION

Gross weight	39,500 lbs.
Payload	8,509 lbs.
(40 passengers with luggage 195 lbs. each)	7,800 lbs.
Cargo	709 lbs.
Max. landingweight	37,619 lbs.
Wing loading (at A. U. W.)	48.4 lb./sq. ft.

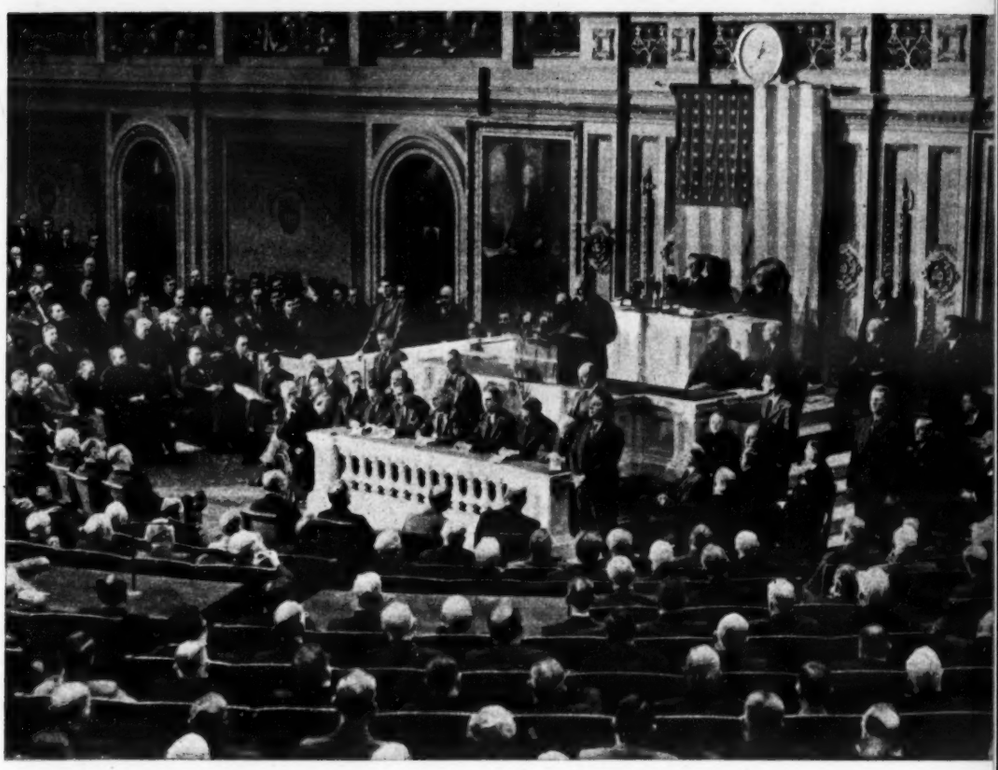
PERFORMANCE

Max. speed at 13,500 ft. and 1,675 B. A. P./Eng.	336 m. p. h.
Average cruising speed at 16,000 ft. and 1,400 B. H. P./Eng.	320 m. p. h.
Max. Economic cruising speed at 16,100 ft. and 1,200 B. H. P./Eng.	300 m. p. h.
Range at above speed with 3/4 hr. fuel reserve for 200 miles against 10-m. p. h. headwind	830 miles
Ceiling on one engine (1,675 B.H.P.)	8,300 ft.
CAR take-off runway at sea level (with water injection)	3 800 ft.
CAR landing runway at sea level and max. landing weight	4,140 ft.
Stalling speed at sea level (full flaps, max. landing weight	85 m. p. h.

The manufacturers guarantee accuracy of cruising speed to within 2 %, runway lengths to within 5 %, and the altitudes to within 10 %.

Originally scheduled for the middle of January, 1947, the first flight will probably have taken place by now. As the assembly line photo of Consolidated Vultee shown, production is already sufficiently highly scaled to enable one to say that, provided nothing of a unexpected nature occurs, deliveries will begin towards the end of summer. However, it will scarcely be possible to compare the performance of the Convair-240 with that of its immediatecompetitor, the Martin 202/303, before the end of the year. And though good marketing possibilities for twin-engined 40-passenger transports will be presented next year, tough competition between Glenn L. Martin and Consolidated is to be anticipated, whereby the outcome will forcedly have to base itself on test-flown performance data alone. *Bi.*

After the attack on Pearl Harbour. Roosevelt addresses Congress.



The "MANHATTAN PROJECT"
The Atom Bombing in Retrospect

Gradually it becomes possible to view individual incidents of the war with aloofness and thus to establish the basis of the overall history of the conflict.

August 10th, 1945, was "V-J Day", the day on which Japan capitulated. *Three official documents*, now available, throw light on the background of this capitulation: *an account by Colonel Henry L. Stimson*, Secretary of the U.S. War Department from 1940 to 1945 of the circumstances leading him to the *Decision to Use the Atomic Bomb* (published in the February, 1947, issue of "Harpers's Magazine"); *a report entitled "Mission Accomplished", prepared by the Assistant Chief of Air Staff (Intelligence)*, published in Washington at the end of 1946 by the U.S. Government and containing accounts of interrogations of Japanese industrial, military and civil leaders; and a *Summary Report on the Pacific War*, prepared by the United States Strategic Bombing Survey and also published by the U.S. Government.

I. Historiography has begun.

The Testimony of War Secretary Henry L. Stimson.

The decision to use atomic bombs in attacks on the Japanese cities of Hiroshima and Nagasaki was one of the gravest made by our Government in recent years. I have therefore decided to record for all who may be interested my understanding of the events which led up to the attack on Hiroshima on August 6th, 1945, on Nagasaki on August 9th, and the Japanese decision to surrender, on August 10th. What follows is an exact description of our thoughts and actions as I find them in the records and in my clear recollection.

Colonel Henry L. Stimson, U.S. War Secretary during the war against Japan.

It was in the fall of 1941 that the question of atomic energy was first brought directly to my attention. At that time President Roosevelt appointed a committee consisting of Vice-President Wallace, General Marshall, Dr. Vannevar Bush, Dr. James B. Conant, and myself. The function of this committee was to advise the President on questions of policy relating to the study of nuclear fission which was then proceeding both in this country and in Great Britain. At the same time I was the President's senior adviser on the military employment of atomic energy.

The original experimental achievement of atomic fission had occurred in Germany in 1938, and it was known that the Germans had continued their experiments. In 1941 and 1942 they were believed to be ahead of us, and it was vital that they should not be the first to bring atomic weapons into the field of battle. Furthermore if we should be the first to develop the weapon, we should have a great new instrument for shortening the war and minimising destruction. At no time did I ever hear it suggested that atomic energy should not be used in the war. All of us of course understood the terrible responsibility involved in our attempt to unlock the doors to such a devastating weapon. But we were at war, and the work must be done.

In the spring of 1945 it became evident that the climax of our prolonged atomic effort was at hand, and it was considered probable that we should by midsummer have successfully detonated the first bomb. This was to be done at the Alamogordo Reservation in New Mexico.

On March 15th, 1945, I had my last talk with President Roosevelt. My diary record

of this conversation gives a fairly clear picture of the state of our thinking at that time. I have removed the name of the distinguished public servant who was fearful lest the Manhattan (atomic) project be "a lemon"; it

Roosevelt signs the declaration of war on Japan.

was an opinion common among those not fully informed.

> The President... had suggested that I come over to lunch today... First I took up with him a memorandum which he sent to me from *** who had been alarmed at the rumours of extravagance in the Manhattan project. *** suggested that it might become disastrous and that we get a body of "outside" scientists to pass upon the project because rumours are going around that Vannevar Bush and Jim Conant have "sold the President a lemon" and ought to be checked up on... I gave the President a list of the scientists who were engaged on it to show the very high standard of them, and it comprised four Nobel Prize men. I outlined to him the future of the project and discussed the two schools of thought that exist in respect to the future control after the war, one of them being continued secrecy and national control, and the other being the international control based upon freedom both of science and of access...

I did not see Franklin Roosevelt again. The next time I went to the White House to discuss atomic energy was April 25th, 1945, and I saw a man whose only previous knowledge of our activities was that of a Senator who had loyally accepted our assurance that the matter must be kept a secret from him. Now he was President and Commander-in-Chief, and the final responsibility in this matter must be his. President Truman accepted this responsibility, and I discussed with him the whole history of the project :

> Within four months we shall in all probability have completed the most terrible weapon ever known in human history, one bomb of which could destroy a whole city... Although we have shared its development with the U.K., physically the U.S. is at present in the position of controlling the resources with which to construct and use it... Nevertheless it is certain that we could not remain in this position indefinitely... It is extremely probable that much easier and cheaper methods of production will be discovered by scientists in the future, together with the use of materials of much wider distribution. As a result, it is probable that the future will make it possible for atomic bombs to be constructed by smaller nations... The world in its present state of moral advancement compared with its technical development would be eventually at the mercy of such a weapon. In other words, modern civilisation might be completely destroyed... The international control of the weapon will involve problems as have never heretofore been contemplated...

The next step in our preparations was the appointment of an Interim Committee, charged with the function of advising the President on the various questions raised by the development of the atomic weapon. I was its Chairman, and its other members were the following : James F. Byrnes, then a private citizen as personal representative of the President ; Ralph A. Bard, Under-Secretary of the Navy ; William L. Clayton, Assistant Secretary of State ; Dr. Vannevar Bush, Director of the Office of Scientific Research and Development, and President of the Carnegie Institution of Washington ; Dr. Karl T. Compton, Chief of the Office of Field Service in the Office of Scientific Research and Development, and President of the Massachusetts Institute of Technology ; Dr. James B. Conant, Chairman of the National Defence Research Committee and President of Harvard University ; and George L. Harrison, who acted as Chairman in my absence. The Interim Committee was assisted in its work by a Scientific Panel whose members were the following : Dr. A. H. Compton, Dr. Enrico Fermi, Dr. E. O. Lawrence, and Dr. J. R. Oppenheimer. All four were nuclear physicists of the first rank . . .

On June 1st, after its discussion with the Scientific Panel, the Interim Committee adopted the following recommendations :

> The bomb should be used against Japan as soon as possible... either against military installation or war plant... It should be used without prior warning (of the nature of the weapon)...

In reaching these conclusions, the Interim Committee carefully considered such alternatives as a detailed advance warning or a demonstration in some uninhabited area. Both of these suggestions were discarded. In order to compel the surrender of Japan, and in view of the still lacking experience with the new weapon, strictest secrecy was indicated . . .

Among the suggestions forwarded to the Interim Committee and the Scientific Panel was one memorandum which questioned using the bomb at all against the enemy. On June 16th, 1945, after consideration of the memorandum, the Scientific Panel made a report, from which I quote the following lines :

> ... Those who advocate a purely technical demonstration would wish to outlaw the use of atomic weapons, and have feared that if we use the weapons now our position in future negotiations will be prejudiced. Others emphasise the opportunity of saving American lives by immediate military use, and believe that such use will improve the international prospects, in that they are more concerned with the prevention of war than with the elimination of this special weapon. We find ourselves closer to the latter views.

The foregoing discussion presents the reasoning of the Interim Committee and its advisers . . . The ultimate responsibility for the recommendation to the President rested upon me, and I have no desire to veil it . . . I felt that to extract a genuine surrender from the Emperor and his military advisers, they must be administered a tremendous shock which would carry convincing proof of our power to destroy the Empire. Such an effective shock would save many times the number of lives, both American and Japanese, than it would cost.

Japan, in July, 1945, had been seriously weakened by our increasing violent attacks. It was known to us that she had gone so far as to make tentative proposals to the Soviet Government, hoping to use the Russians as mediators in a negotiated peace. But there was as yet no indication of any weakening in the Japanese determination to fight rather than to accept unconditional surrender. If she should persist in her fight to the end, she had still a great military force . . . amounting to about 5,000,000 men in the home islands and seized territories. The Japanese Army was in much better condition than the Japanese Navy and Air Force. The Navy had practically ceased to exist, the Air Force had been reduced mainly to reliance upon Kamikaze, or suicide attacks . . .

The strategic plans of our armed forces for the defeat of Japan, as they stood in July, 1945, had been prepared without reliance upon the atomic bomb, which had not yet been tested in New Mexico. We were planning an intensified sea and air blockade, and greatly intensified strategic air bombing, through the summer and early fall, to be followed on November 1st by an invasion of the main island of Honshu in the spring of 1946. The total U.S. military and naval force involved in this grand design was of the order of 5,000,000 men. We estimated that if we should be forced to carry this plan to its conclusion, the major fighting would not end until the latter part of 1946, at the earliest. I was informed that such operations might be expected to cost over 1,000,000 casualties, to the American forces alone.

With these considerations in mind, I wrote a memorandum for the President on July 2nd :

> ... There is reason to believe that the operation for the occupation of Japan following the landing may be a very long, costly and arduous struggle on our part. The terrain, much of which I have visited several times, has left the impression on my memory of being one which would be susceptible to a last ditch defence...
>
> According to my recollection it will be much more unfavourable with regard to tank manoeuvring than either the Philippines or Germany... We shall, in my opinion, have to go through with an even more bitter finish fight than in Germany... A question then comes : Is there any alternative to such a forceful occupation of Japan which will secure for us the equivalent of an unconditional surrender of her forces and a permanent destruction of her power again to strike an aggressive blow at the "Peace of the Pacific"? I am inclined to think that there is enough such chance to make it well worth while our giving them a warning o what is to come... The warning should be given in ample time to permit a national reaction to set

in... Japan has no allies. Her Navy is nearly destroyed and she is vulnerable to a surface and underwater blockade which can deprive her of sufficient food and supplies for her population. She is terribly vulnerable to our concentrated air attack upon her crowded cities, industrial and food resources. She has against her not only the Anglo-American forces but the rising forces of China and the ominous threat of Russia. We have inexhaustible and untouched industrial resources... and a great moral superiority through being the victim of her first sneak attack... Japan is not a nation composed wholly of mad fanatics... I think the Japanese nation has the mental intelligence and versatile capacity in such a crisis to recognise the folly of a fight to the finish and to accept the proffer of what will amount to an unconditional surrender... I think she is better... than Germany was... for her liberals yielded only at the point of the pistol and, so far as I am aware, their liberal attitude has not been personally subverted in the way which was so general in Germany. On the other hand, I think that the attempt to exterminate her armies and her population by gunfire or other means will tend to produce a fusion of race solidity and antipathy which has no analogy in the case of Germany. We have a national interest in creating, if possible, a condition wherein the Japanese nation may live as a peaceful and useful member of the future Pacific community. It is therefore my conclusion that a carefully timed warning be given to Japan by the chief representatives of the United States, Great Britain, China, and, if then a belligerent, Russia, by calling upon Japan to surrender and permit the occupation of her country in order to ensure its complete demilitarisation... This warning must be unambiguous...

The warning to Japan was issued in the Potsdam ultimatum of July 26th, which very closely followed the above memorandum of July 2nd. On July 28th the Premier of Japan, Suzuki, rejected the Potsdam ultimatum by announcing that it was " unworthy of public notice ".

In the face of this rejection we could only proceed to demonstrate that the ultimatum had meant exactly what it said when it stated that if the Japanese continued the war, " the full application of our military power will mean the inevitable and complete destruction of the Japanese armed forces and just as inevitably the utter devastation of the Japanese homeland ".

For such a purpose the atomic bomb was an eminently suitable weapon. The New Mexico test occurred while we were at Potsdam, on July 16th. It was immediately clear that the power of the bomb measured up to our highest estimates . . . Because of the importance of the atomic mission against Japan, the detailed plans were brought to me by the military staff for approval . . . I struck off the list of suggested targets the city of Kyoto. Although it was a target of considerable military importance, it had been the ancient capital of Japan, and was a shrine of Japanese art and culture. I approved four other targets, including the cities of Hiroshima and Nagasaki . . . The one was an army centre ; the other was naval and industrial. Hiroshima was the headquarters of the Japanese Army defending southern Japan and was a major military storage and assembly point. Nagasaki was a major seaport . . . We believed that our attacks had struck cities which must certainly be important to the Japanese military leaders and we waited for a result. We waited one day.

The Japanese capitulation came on August 10th and was based on the Potsdam terms, with a reservation concerning the sovereignty of the Emperor. The Allies' final terms were accepted on August 14th by the Japanese, and the instrument of surrender was formally signed on September 2nd. Our great objective was thus achieved . . .

The two atomic bombs which we had dropped were the only ones we had ready and our rate of production at the time was very small. Had the war continued until the projected invasion on November 1st, additional fire raids of Boeing B-29's would have been more destructive of life and property than the very limited number of atomic raids which we could have executed in the same period. But the atomic bomb was more than a weapon of terrible destruction ; it was a psychological weapon . . . As Dr. Karl Compton has said, " it was not one atomic bomb, or two, which brought surrender ; it was the experience of what an atomic bomb would actually do to a community, plus the dread of many more, that was effective ".

Henry L. Stimson, who accepts the responsibility for the first military use of the atomic bomb, states about himself :

... My chief purpose was to end the war in victory with the least possible cost in the lives of the men in the armies. In the light of the alternatives which, on a fair estimate, were open to us, I believe that no man in our position and subject to our responsibilities, holding in his hands a weapon of such possibilities for accomplishing this purpose and saving those lives, could have failed to use it and afterwards look his countrymen in the face... As I read over what I have written, I am aware that much of it, in this year of peace, may have a harsh and unfeeling sound. It would perhaps be possible to say the same things and say them more gently. But I do not think it would be wise... The face of war is the face of death, and death is an inevitable part of every order that a wartime leader gives. The decision to use the atomic bomb was a decision that brought death to over a hundred thousand Japanese. No explanation can change that fact and I do not wish to gloss it over. But this deliberate, premeditated destruction was our least abhorent choice. The destruction of Hiroshima and Nagasaki put an end to the Japanese war... But they also made it wholly clear that we must never have another war. This is the lesson men and leaders everywhere must learn, and I believe that when they learn it, they will find a way to lasting peace. There is no other choice.

II. What if the atomic bombs had not been dropped?

Testimony from the American Records.

The Japanese-American conflict, the war in the Pacific, war the first war in the history of the world during the course of which not a single soldier of either opponent set foot on the soil of the enemy's homeland until the actual cessation of hostilities.

The Pacific war was unique in many respects : in all the battles that were fought, losses in men were relatively low ; but the losses amongst the civilian population of the vanquished were considerably greater than those suffered by the armed forces. American statisticians have calculated that in the last nine months of the war Japanese civilian casulties amounted to about 806,000, whereas the casualties incurred by the Japanese armed forces throughout the whole duration of the war numbered 780,000 killed, wounded and missing. Noteworthy is, too, that for the first time in the history of the world a naval blockade was tight enough to bring about the complete collapse of the enemy's entire industry.

Another point about the war in the Pacific : this war furnished the first irrefutable proof of that much-discussed theory of the mastery of the air, which was first laid down in writing by General Giulio Douhet, the former Italian Air Force chief and military author, who died as long ago as 1930 and was morally rehabilitated only after his death. In his book, " Il Dominio dell'Aria ", he states :

I have frequently invited my military and naval critics to explain to me how they proposed to operate in the face of enemy mastery of the air. Some of them replied by asserting that in the air neither victory nor defeat was possible. Others clung to the literal meaning of " mastery of the air ". I was forced, therefore, to make it clear in every detail how I wished this term to be interpreted. I did not want it to mean that everything down to the enemy's flies should be kept out of the air, but merely that it should prevent the enemy's air arm from conducting any decisive operation anywhere.

This has actually occurred in the Pacific war.

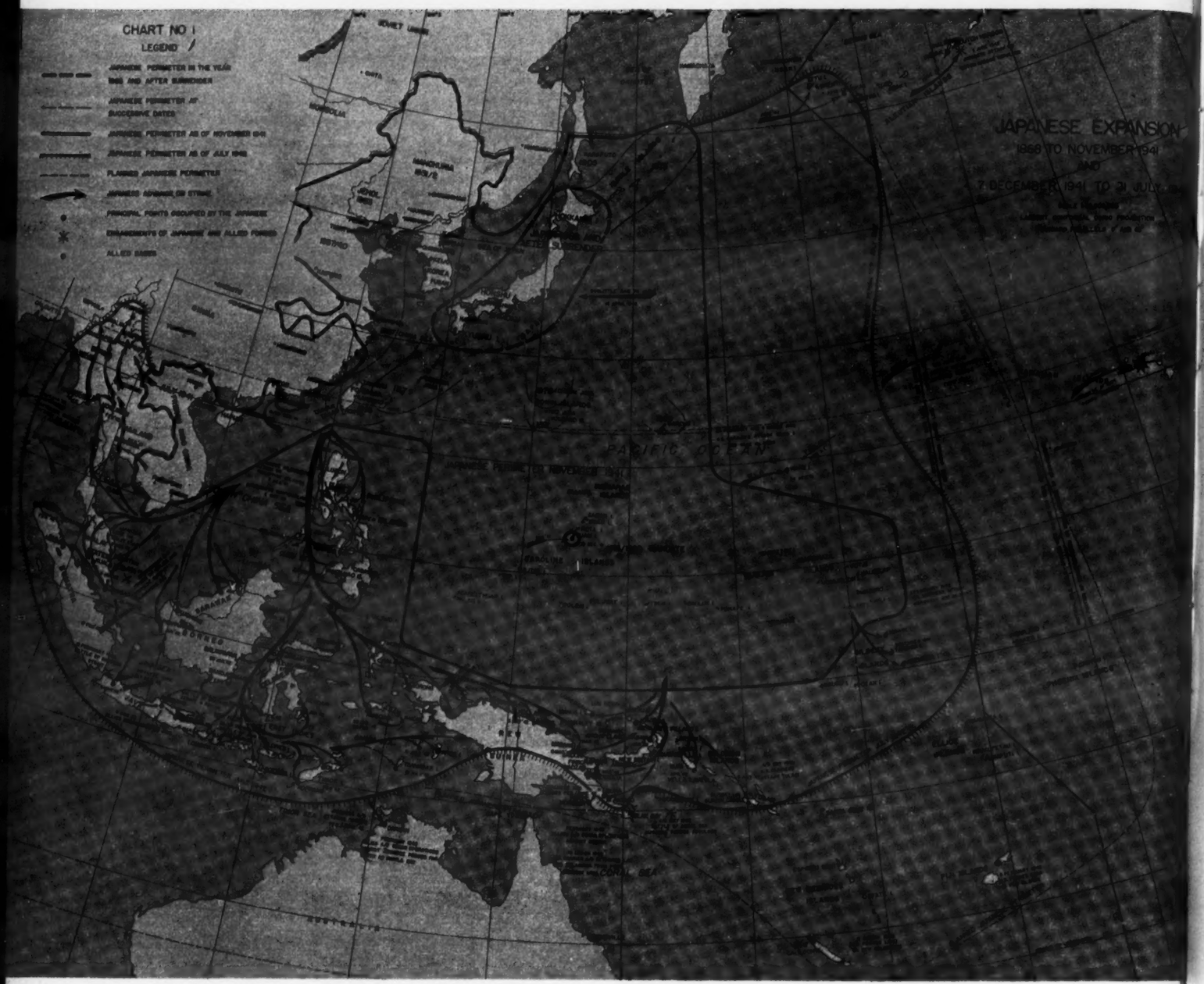
The Americans have a weakness for gathering masses of small details, a weakness which might well be called " Gallup spirit ", after the well-known Institute of Public Opinion. That the intelligence services of both opponents used prisoners of war for the acquisition of strategically and tactically valuable information while the war was still in progress is comprehensible. But American military and civil organizations continued their systematic interrogations long after the end of the war and by no means confined their efforts to Japanese officers and men : they addressed themselves to industrialists and workmen, officials and journalists, artisans and housewives, Christian missionaries, Buddhist monks and Shinto temple guards :

" Prior to actual cessation of hostilities on August 14th, 1945, did you ever believe that defeat of Japan was inevitable ? When, and why ?... Describe the effects of incendiary attacks. How did they affect Japan's ability and desire to continue the war ? "

No question remained unasked, and no section of the population evaded the interrogators. The results of this detail work are combined in *Mission Accomplished,* the publication cited at the beginning of this article. Of importance is the fact that those interrogated were unanimous in their declaration that *Japan was defeated by the Allied air forces* alone.

Rear-Admiral Toshitane Takata, of the Naval General Staff, declared : — " ... Of the three forces — air, sea and land — air, by a wide margin, contributed most to the defeat of Japan. "

Grand-Admiral Osami Nagano, author of the plan for the attack on Pearl Harbour and who died



Map of Pacific Operations. Inside line around Japan : Japanese ruled area in 1868. Second line : Japan's extension up to November, 1941. Third line : Japanese ruled area in July, 1942. Outside line : Extension planned by the Japanese.

in a military hospital in Tokyo a few weeks ago while awaiting trial as a war criminal, stated : — " After the war started, in the early stages, your submarines constituted the main difficulty in getting our oil north on our ships, but afterwards it was your air force ; and I believe that the air force, once it got operating, was more effective than the submarines in checking the shipments of oil. Generally speaking and applying to practically all phases of our operations in the south, I had the feeling that if we only had more airplanes we could have carried out all of our operations according to plan... "

A third commentary : General Toshizo Nishio, former member of the Supreme Military Council and Military Governor of Tokyo, said, " the army was developed proportionately to the best of the ability of the Japanese industrial capacity. However, since I believe myself that it was air power which beat Japan, the general feeling would be, in my own personal opinion, that future wars would be fought entirely in the air. It is very unfortunate that the Japanese were not willing to make the decision to discard land forces and throw all their creative effort in an air arm capable of carrying out such a war... "

The war in the Pacific began, as will be recalled, with a lightning series of Japanese conquests which was nothing but a " drive for raw materials ". Japan had to import more than half of all strategic raw materials and food. To maintain her air forces, she had to import 80 percent of the necessary petroleum, 90 percent of her bauxite, and all her rubber from the South Pacific, an area which the U.S.A. had closed to Japan even before the outbreak of war. Japan sought to acquire elbow room.

The Americans, on the other hand, had begun to stake their claims to the air space in the Pacific area in 1936, when Pan American Airways inaugurated its commercial air service from San Francisco to Hong Kong. Another route, from the U.S.A. to Alaska and Vladivostok, was being prepared by the same company. The came the big " surprise ". A nation, discovered by western civilization only 80 years before, succeeded in occupying an area of over 1,000,000 square miles without encountering any serious resistance . . .

The *Summary Report, Pacific War,* also mentioned at the beginning of this article, frankly states the causes of America's weakness at the time of Pearl Harbour :

> ... December 7th, 1941, found the United States and its Allies provocatively weak in the Pacific, particularly in land and carrier-based air power. The Allied air groups actually in the Pacific were not only few in number but, in large measure, technically inferior to those of the Japanese. The Japanese strength had been underestimated. Ninety Curtiss P-40 fighters and 35 Boeing B-17 bombers

in the Philippines could not be expected to check the Japanese push southward. Three of our seven aircraft carriers were in the Atlantic and one training in the Gulf of Mexico... Our three lightly supported aircraft carriers in the Pacific did not constitute a sufficient force...

With the help of tables, the report then proves that the Japanese started the war with 2,625 modern aircraft, which were opposed by a total of 1,290 aeroplanes of mostly obsolete designs belonging to the Americans, British, French, Dutch and the others that were " surprised " in the entire Pacific area . . . And the American aircraft industry was operating at relatively slow speed.

The result was not really as astonishing as it seemed at the time, and the official criticisms of the initial operations sound pretty comprehensible today : " The United States plan had little basis in reality ".

But the same report also points out that " *even at that time we had begun to see more clearly than the Japanese the full scope of the basic requirements for air power* ".

It was soon found that the aggressor operated according to a plan which, in the long run, must overstrain his industrial resources. The Japanese had figured out that after conquering an area within a predetermined perimeter, between the Kuriles, Wake, Marshall and Gilbert Islands, the Bismarck Archipeligo, Timor, Dutch East Indies, Malaya and Burma, they would be left undisturbed in possession of the world's richest raw material resources. When the drive into this area was accomplished more easily than they had ever dreamed, they began to consider extension beyond the original territory and included also Midway, the Phoenix and Fiji Islands, New Caledonia, the New Hebrides and all of New Guinea in their " Greater Asia Project ". They calculated that the U.S.A. and her Allies were tied down for years in their struggle with Germany and might even be defeated. They also calculated that the Americans, weakened by Pearl Harbour, could not take the offensive for at least two years. Correct in theory, they arrived at the conclusion that these facts would give Japan time to consolidate her conquests.

On the other hand it may be recorded as a historical fact that the Japanese never contemplated an invasion of the United States, and that Admiral Yamamato's alleged boast that Japan would dictate peace in the White House was never made. But the Japanese committed the error of confusing the establishment of operational plans with the determination of war aims : without crushing the enemy's armed forces and complete destruction of the enemy's war potential no war can be won. It is absurd to assume that an unbroken antagonist will accept without further ado an important loss of territory and recognise it as a *fait accompli*.

These are the two psychological reasons which ultimately change the picture. Of the

American aircraft carrier off Midway.

British a South Sea poet once wrote : " The Englishman refuses to acknowledge that he has been killed, and that's why in the end he wins every battle ". And of his countrymen Admiral Soemu Toyoda, the Chief of the Japanese Fleet, remarked : " As it turned out, we had simply taken in too much territory with the strength that we had . . . "

Then followed the Japanese reverses :

Naval and air battles in the Coral Sea, from May 4th to 8th, 1942; American dive bombers sink the aircraft carrier " Shoho ".

Four weeks later, naval and air battle off Midway : Boeing B-17 four-engined and Martin B-26 twin-engined bombers send three more Japanese carriers to the bottom and damage a fourth, which is finished off by submarines.

A statement by Captain Ohara of the aircraft carrier " Soryu ", which took part in the battle off Midway : " The loss of the carriers meant loss of control of the air. We did not think that we could capture Midway after we lost air control, so we returned to Japan... "

Midway was the turning point. Besides the aircraft carriers, the Japanese had lost four battleships, about 250 aircraft, and their crack air crews. After Midway, the Japanese had four carriers fit for action, but of these only one was a large one ; the remainder of their carriers were under repair or construction. On the other hand, the United States had three large carriers operating in the Pacific, thirteen light carriers, and fifteen escort carriers. *A balance of naval air power in the Pacific was thus achieved at Midway,* and on August 7th, 1942, American forces landed on Guadalcanal.

Of greatest importance at the time was a little publicised event of small magnitude in itself : on September 14th, 1942, the *Boeing*

Crew anxiously watching the battle from the carrier's deck.

B-29 "Superfortress" heavy bomber prototype took off for its initial flights from the airfield of the Boeing Aircraft Co. in Seattle, Wash.

The American advance started in 1943, initially in the form of small, lightning attacks.

The Japanese position was attacked at its north eastern corner in May, 1943, when the assault on the island of Attu was launched. In the south the attack started with the advance on Munda. In September the Japanese were forced to evacuate Salamaua and other points on New Guinea. The fighting for the base of Rabaul proved extremely destructive to them. In the Central Pacific they lost the Gilbert Islands.

Statement by Colonel Kaneko, a Staff officer of the Japanese 4th Air Force located in New Guinea : "The Americans created the greatest delaying effect to Japanese air operations by their heavy Consolidated B-24 raids against our aircraft on the ground. This actually did more damage than the low level and strafing attacks... The net effect was an air blockade which cut off sea transportation and stopped re-supply. Furthermore, the morale of the men was greatly affected through physical fatigue. We attribute the American success, first, to the great superiority and number of aircraft, second, excellent interplane communications, and third, the high concentration of bombs..."

Statement by Vice Admiral Omori, Commander-in-Chief, Rabaul Assault Forces : "We planned to use Rabaul as a main point of the New-Guinea-Bismarck-Solomon perimeter defence. During 1943 we attempted to hold the line at all costs... We lost most of our best pilots, many valuable ships and much well-trained military personnel that we were unable to replace..."

Statement by Lieutenant-General Arisue, general staff officer and chairman of the Army-Navy Liaison Committee : "It was thought necessary to hold Rabaul at all costs in order to protect the main fleet base at Truck... We lost about 600,000 tons of shipping there, mostly as a result of attacks by Boeing B-17's and Consolidated B-24's. The landings at Lae and Bougainville demonstrated the Allied intention of by-passing Rabaul and showed that the campaign was lost, but it was already too late to evacuate..."

Boeing B-29 takes off from Saipan to attack Tokyo.

And the "Summary Report" states : "*. . . It was late 1943 when we attained numerical superiority over Japanese air forces in the field*".

From a production point of view, the three nations fighting in the Pacific presented the following picture, though obviously it must be kept in mind that a large percentage of the Allied aircraft production went to the European battlefields :

Aircraft Built :	*1942*	*1943*	*1944*
U. S. A. . . .	47,859	85,930	96,359
Great Britain .	23,671	26,263	29,220
Japan	9,308	16,296	28,220

The final part of the war in the Pacific could be illustrated, without warping history, in the form of a double diagram : on the left, the production of the American aircraft industry, the capture of air bases, and the raids on Japan launched from them ; on the right, the resulting social, industrial and political consequences in the Japanese Empire.

On the left hand side one would have to start with the occupation of Saipan, in the Marianas, which was achieved on July 9th, 1944. *Everybody in Japan felt that the loss of Saipan meant the end.* The Boeing B-29 "Superfortress" heavy bombers later took off from Saipan, and their first raid on Tokyo, on November 24th, 1944, resulted in 185,000 victims in the poorer quarters of the Japanese capital, including 100,000 killed. In the same night, looting began. The police were helpless.

Saipan fell on July 9th, 1944. A week later the Government, headed by General Tojo, who had led the nation into war, resigned. *The new Government, formed by General Koiso on July 17th, 1944, was supposed to put out peace feelers.* But, under military pressure, the new Government remained hesitant, with the result that the war continued for another thirteen months after the decision had actually fallen.

On October 20th, 1944, the Americans set foot on the Philippines once more. This was the signal for the beginning of those desperate *suicide or Kamikaze attacks,* which no doubt figure among the most heroic self-secrifices in history. The American "Summary Report" points out :

From October, 1944, to the end of the Okinawa campaign (June, 1945), the Japanese flew 2,550 Kamikaze missions, of which 475, or 18.6 percent, were effective in securing hits or damaging near misses... Had the Japanese been able to sustain an attack of greater power and concentration, they might have been able to cause us to withdraw or to revise our strategic plans.

A statement by Lieutenant-Colonel Jin, a general staff officer : "Suicide attack was the only sure and reliable type of attack as it had to be made with personnel whose training had been limited because of shortage of fuel."

But, as the Russian General Alexander Suvoroff said, "*Every dead soldier is an object of hero worship — but simultaneously a gap in the front line*".

The end of the war in the Pacific may be of greater interest to the statistician than to the strategist. The production of the Japanese aircraft industry fell off, according to Lieutenant-General Kawabe, by 50 or 60 percent. A high official of the Ministry of Munitions stated that fuel production dropped by 61 percent. It was ascertained that at the time of the capitulation, the petroleum refineries had lost 83 percent, aircraft engine factories 75 percent, and aircraft works 60 percent, of their capacity.

Bombing raids destroyed 2,510,000 houses ; 615,000 buildings were torn down by the Japanese air raid precautionary services in order to prevent the spreading of fires. Air raid shelters were few, so that the losses amongst the Japanese civilian population, quoted earlier, are understandable.

On March 9th, 1945, a new American bombing plan was put into to effect : attacks by night from low altitude. On March 10th, the heaviest attack on Tokyo was carried out, causing 1,000,000 victims, including 100,000 killed.

On April 1st, 1945, the Americans landed on Okinawa, and on April 7th, the Koiso Administration was replaced with one under the old, retired Admiral Baron Suzuki.

. . . The atomic bombs fell on a country whose industry was in its last throes and whose battle spirit had been broken. They extorted another terrible blood toll. But politically and historically their only effect was to curtail the night session of the War Council that had been convened by the Emperor who no doubt would have been forced to strike the flag of the Rising Sun even without the atomic bombs. EEH/EH.

Era of Rotary Power

Practical Prospects for Aviation in Next Decade

by G. Geoffrey SMITH, M.B.E., London.

G. Geoffrey Smith—as he himself says—has followed aircraft engine progress from the days when Wright first flew and Blériot crossed the Channel ; he was engaged on aircraft engines as a Captain in the former Royal Flying Corps and has made a study of them ever since. Today, Geoffrey Smith, M.B.E., is Editorial Director of Flight *and* Aircraft Production, *etc., Director, Flight Publishing Co., Ltd., and Associated Iliffe Press, Ltd. He was one of the first aviation writers to recognise the technical possibilities offered by rotary power, which accounts for the many articles, books and broadcasts on the subject under his name. His confidence in rotary power was justified : his book,* Gas Turbines and Jet Propulsion for Aircraft *is today considered a standard work on the subject, and is used in both British and American training centres for military and civil airmen as well as in technical colleges ; first published in 1942, four editions have already appeared, and the book has also been printed in the U.S.A.*

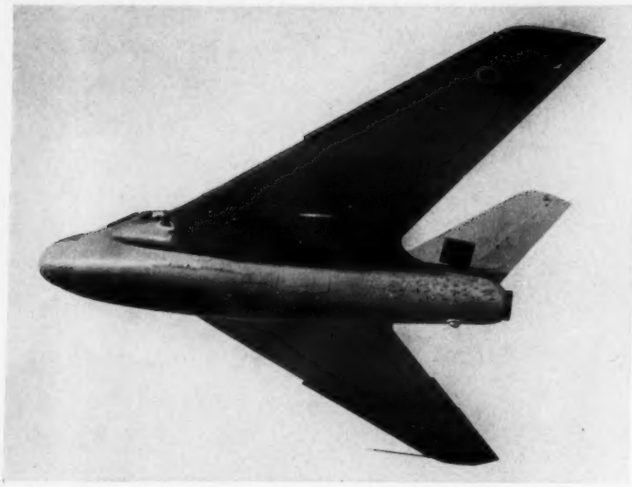
There can be no doubt that the successful development of the aircraft gas turbine marks a phase change in the history of mechanical flight. At one step it has changed propulsion units from reciprocatory to purely rotary motion, reduced specific weight and simplified production, installation and maintenance. Its efficiency improves with both velocity and altitude, and power output higher than is practicable in any form of reciprocating unit can readily be obtained. As a consequence it has already radically influenced the design of aircraft but commercial advantage will be fully realised only when aerodynamically improved airframes are evolved.

It must be emphasised that existing modern aircraft were designed initially some years ago for reciprocating power units and performances which, by present day standards, must be regarded as relatively modest. From the dawn of the industry the aircraft designer has continuously demanded more powerful engines of less weight and occupying less space to power his advanced designs. Now the tables are turned and the engine builder is demanding improved aircraft to exploit to the full the potentialities of the new rotary power unit. The aerodynamic problems associated with high speed flight, only imperfectly appreciated in the past, now suddenly confront the aircraft designer.

The gas turbine is particularly suitable for aircraft. During his early advocacy of the turbine, Air Commodore F. Whittle confounded his critics with evidence that whilst the gas turbine under static conditions at ground level was relatively inefficient it would be a different proposition when travelling at hundreds of miles an hour at a relatively high altitude. The lower temperature and lower density of the air and the beneficial influence of ram compression under such conditions would transform it into a practical propulsion unit.

Subsequent developments, amply endorsing his views, have been amazingly rapid. The following dates mark the progress in Britain :

First successful run on the test bed	April, 1937
First flight	May, 1941



De Havilland D.H. 108 " Swallow " single-jet experimental craft.

First fighter in action (against VI buzz bombs)	Summer, 1944
World Speed Record, 606 m.p.h.	Nov., 1945
World Speed Record, 616 m.p.h.	Sept., 1946
Installed in an air liner	Aug., 1946
Paris to London flight in 23.5 min. (520 m.p.h.)	Dec., 1946

In Britain development of the aircraft gas turbine has been mainly in the hands of aircraft engine builders who have a background of air requirements, installation and operating experience. In contradistinction some countries have been inclined to entrust the development to the builders of stationary and marine steam turbine plants.

We are gratified with progress from our angle, and are proud of our world speed record. The Gloster " Meteor " was the first aircraft officially to exceed 600 m.p.h., and soon improved this performance by a flight at 616 m.p.h. Actually we were very unfortunate regarding weather on the record runs. Air temperature is critically important and during the period of the attempts was unusually low. Had the temperature been at normal level we would certainly have established a record of 1,000 km/h. (621.37 m.p.h.). Actually this speed was exceeded during the various test runs. We had power in reserve and the aircraft to achieve it. On this score we have no doubts.

In view of such a rapid advance it seems unwise to plot future speeds too precisely. Personally, I think some time will elapse before we reach supersonic speeds with piloted aircraft. Test data are difficult to obtain and slow to accumulate. Every step must be safeguarded as far as possible to avoid hazard to the pilot. Sensitivity of controls at speed and altitude, icing of leading edges as well as ice entering the compressor are problems still unsolved.

We have the pilotless Vickers rocket, designed expressly for the purpose of investigating trans-sonic phenomena. This model craft, having a wing span of 8 ft. and a fully-tanked weight of 800 lbs., is virtually a reduced scale version of the earlier piloted Miles M.52 jet-propelled project which had a span of 26 ft. Wing, tailplane and stabiliser fin are all of truly bi-convex section with sharp leading and trailing edges. On early examples the wings are straight but later models will most probably be fitted with sweptback wings.

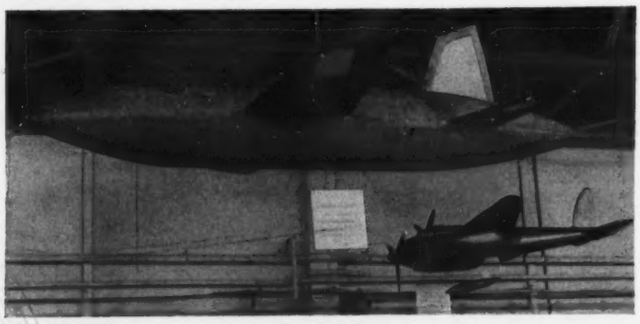
Powered by a liquid rocket motor, using C-Stoff and T-Stoff fuels, it is expected to attain a speed of 880 m.p.h. in level flight at 35,000 ft. This is equivalent to a Mach number of 1.3 at this altitude. It will be taken aloft by a " Mosquito " and at 36,000 ft. launched into a glide. At 35,000 ft. it levels out, the rocket motor is started and the craft accelerates to reach sonic speed 18 sec. after release. Continued acceleration raises the velocity to the maximum of 880 m.p.h. in a total period of 70 sec. from release. By this time the fuels are exhausted, the motor is cut, speed falls to below sonic velocity, controls are locked over and the model dives to earth.

During flight, measurements of static and dynamic pressure, acceleration, combustion chamber pressure, and tailplane incidence, are fed to a multi-channel telemetering transmitter sending out signals for reception by a ground receiver. Simultaneously a transponder unit receives a signal from the ground and re-transmits the signal on a different frequency to enable the craft to be tracked by radar.

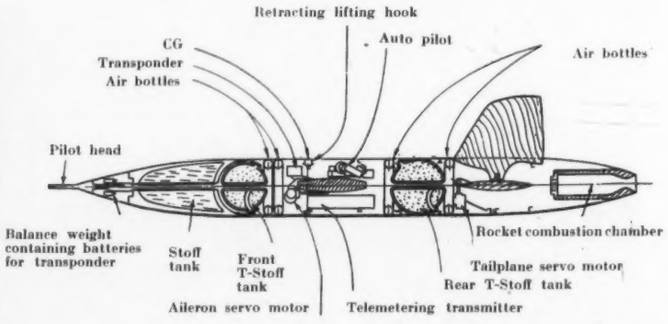
On the application of turbine power plants to transport and commercial aircraft we can speak with more assurance. My conviction, which I have frequently expressed in Britain and in America, is that turbines will come into common use in the next year or two. Our experimental fourteen-seater Avro " Lancastrian " air liner with two Rolls-Royce " Nene " jet engines and two Rolls-Royce Merlin reciprocating engines is a pointer. It is not a so-called " flying test bed ". The jet engines are not additional to the normal engines but are substituted for two of them. They not only perform their share of the work but in the air can do all the work and carry the two shut-down reciprocating engines. It is not a stunt but a well-conceived and well-executed step on the way to complete conversion from reciprocating to rotary power units.

It is a fully-equipped air liner and, as evidenced by the trip to the recent Paris Aero Show, is entrusted with the transport of a full

Model of Vickers pilotless experimental rocket, to serve for trans-sonic research.



Schematic sectional drawing of the Vickers rocket.



Avro " Lancastrian ", experimentally fitted with two R.-R. " Merlin " piston engines and two R.-R. " Nene " jets.

load of " Very Important Persons ". Its function is to obtain operating experience. When the normal engines are cut out in the air it provides amazing proof of the advantages offered by the turbine for quiet and vibrationless flight. Hundreds of passengers already have had a convincing demonstration of these attributes. It has been a revelation to many sceptics. Furthermore, the noise of air flow over the aircraft, obvious for the first time, has heightened the realisation by designers that improved aerodynamic contours, smooth surfaces and complete elimination of excrescences are now imperative essentials. At an altitude of 10,000 ft., this 62,000 lbs. liner cruises at 330 m.p.h. on all four engines and at 260 m.p.h. on the two jets alone. The substitution of two jet units for two reciprocating engines raised the ceiling from about 26,000 ft. to 30,000 ft.

One does not have to possess the gift of prescience to suggest that jet engines will before long replace *all* the reciprocating engines or that we shall soon undertake more ambitious journeys than London to Paris. This year we will have in the air a " Tudor " liner equipped with four " Nene " jet units and capable of cruising at about 400 m.p.h.

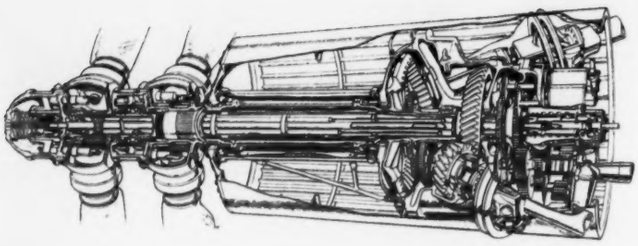
We are wholeheartedly committed to the gas turbine. At present we are in regular production with jet units developing 5,000 lbs. static thrust. When operated in an aircraft flying at 600 m.p.h. this is equivalent to a piston engine of 16,000 H.P. driving a propeller which at that speed would have an estimated efficiency of 50 per cent. As the weight of the unit is under 2,000 lbs. the equivalent specific weight of more than 8 H.P. per lb. is astounding. There is no wonder that all our previous standards of performance must be abandoned. For example the " Meteor " fighter, equipped with two Rolls-Royce " Derwent " jets each producing 4,000 lbs. static thrust, has the phenomenal rate of climb of 30,000 ft. in three minutes. Imagine travelling from sea level to the altitude of the summit of Mount Everest, the world's highest mountain, in less than 180 sec.

A static thrust of 5,000 lbs. per unit is by no means the limit. We are already building experimental units having a 50 per cent greater output and have projects under development for units of 100 per cent greater power. Only considerations of frontal area and space occupied set a limit in this respect. Doubtless, the policy of spreading risk by employing a plurality of stardardised medium-power units in preference to one or two monster power plants will be followed in the turbine-driven liners of the future. Britain has sold turbine jet units, or granted licences for production, to the U.S.A., the U.S.S.R., France and China. We have sold complete squadrons of jet-propelled fighters to Sweden and Switzerland.

To exploit the economic advantages offered by the gas turbine we must fly both very fast and very high in the cool thin air, probably not less than 400 m.p.h. at 40,000 ft., and preferably over 500 m.p.h. at 50,000 ft. Of course military aircraft can be flown by specially trained crews at high speeds at lower altitudes but bumpy atmospheric conditions and sudden down draughts, liable to be encountered at medium altitudes, render ultra-high speeds undesirable for regular passenger services. In the present state of knowledge, therefore, this suggests that very high speeds will not be required on the shorter routes where the climb to high altitudes is not justified. The need for thoroughly reliable pressurised accommodation is apparent, and that in itself is a problem of no mean order in the case of large cabins.

An obvious intermediate type is the high-speed, long-range mail place. We are well ahead in preparations for this class of aircraft and by the time this appears in print the Armstrong Whitworth tailless mail plane will probably have been flown. Very modern in

E.W. Hives (left), Managing Director, Rolls-Royce, Ltd., in conversation with the Author.



Gear box arrangement in the engines for the Bristol 167, arranged in pairs in the wing leading edge.

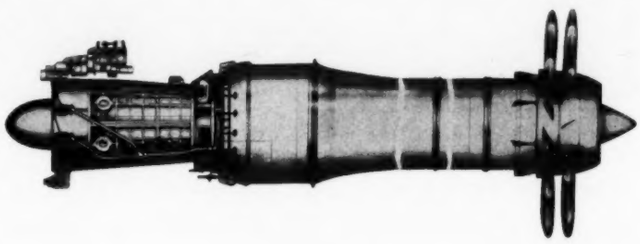
conception, it has been evolved from the Armstrong Whitworth towed glider from which much knowledge has been gained relating to stability and control. The swept-back wing has a span of 90 ft. and is fitted with tip rudders. To delay the tendency to wing tip stall, a system of boundary layer removal is provided for the outer wing surfaces. Apart from producing the necessary propulsive effort the two 5,000 lb. thrust " Nene " jet units warm and pressurise the cabin for the two-man crew, suck off the boundary layer from the wing and provide a thermal de-icing system for the wing leading edge. The freight capacity in a space of 300 cu. ft. is 4,000 lbs. Total weight will be 32,700 lbs. giving a comparatively low wing loading of 24.8 lb./sq. ft. The performance is expected to be quite outstanding.

For the mammoth air liners now building, existing reciprocating engines, although producing over 3,000 H.P. each, are not really adequate. There is no prospect of obtaining a substantial increase in power output unless present standards of size, frontal area and weight are abandoned ; this apart from the inevitable complexity of installation and control of the engines and their auxiliary services. To obtain a performance which will meet the requirements of the immediate future, piston engines will undoubtedly be superseded by turbine units. Already plans are being modified and adapted to equip aircraft under construction with turbines, as soon as flying tests are completed with the originally-intended piston engines.

Different but equally valid reasons will compel the use of turbines for the majority of medium-speed, medium-altitude and medium-range liners. Size, weight, freedom from vibration, and relative silence cannot be equalled by the piston engine ; simplicity of production, installation and maintenance will rapidly assume importance ; and as production is standardised and increased in volume, initial cost will be lowered.

There are two schools of thought on the policy of a change-over from piston engines to turbines in aircraft likely to be commercially available in the next decade. One holds it advisable immediately to develop the turbine to drive an airscrew in order to obtain economical operation at medium altitude and speed. The other suggests that by the time the turbine-airscrew unit is fully developed, such aerodynamic progress will have been achieved that aircraft performance will be stepped up and the jet will economically take precedence. Probably both trends will progress side by side. The highly competitive character of air transport operation will not permit the immediate advantage of the turbine-airscrew to be neglected. Nor, in my opinion, will it admit of delay until the full potentialities of the turbine-jet can be realised . It would seem that the turbine with a gear-driven airscrew, or tandem, contra-rotating airscrews, will have a useful life for civil aircraft for a number of years. Turbine jets will be a *sine qua non* for military craft until supplemented or possibly superseded by ramjets and eventually rocket motors.

Britain is vigorously producing both types and the table giving particulars of existing models can be extended by a number of further designs now undergoing development. Amongst these may be mentioned a larger Bristol, the " Proteus ", with a shaft output of 3,500 H.P., and the new 750-lb. Fedden axial-flow unit producing 1,350 H.P. Rolls-Royce also has the " Dart ", a small turbine-airscrew

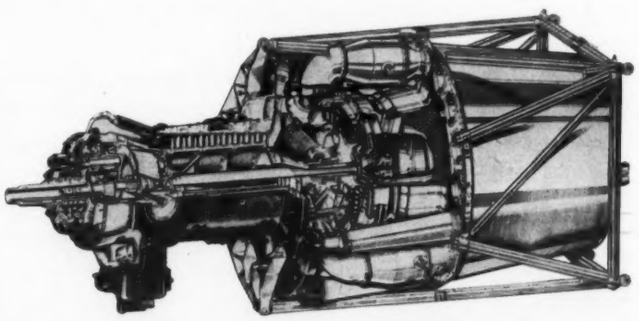


Metrovick F.5 jet unit, developed by Metropolitan-Vickers Electrical Co.

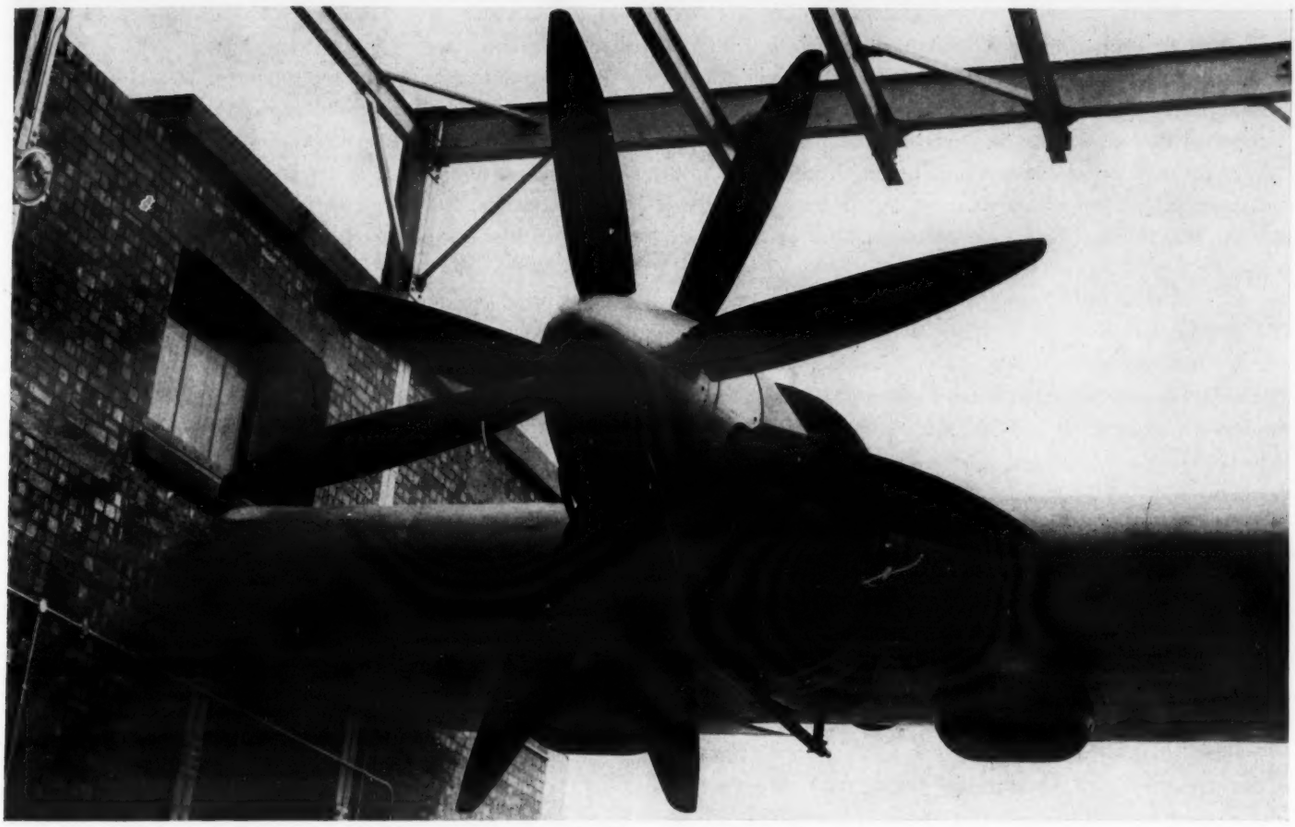
with an axial compressor, designed to give about 1,100 H.P. The Napier Company, builders of the 3,000-H.P. " Sabre " 24-cylinder, sleeve-valve piston engine, are also actively developing turbine units.

Metropolitan-Vickers F.3 has a fully-ducted, thrust-augmenting fan, but in the new F.5 design open contra-rotating pusher fans are driven by a four-stage turbine. Having a diameter of 5 ft. 6 ins. and absorbing 2,300 H.P., they are, in effect, small airscrews. The total weight of the augmenter unit, however, is only 600 lbs., or less than half that of a conventional airscrew for equivalent power. It thus becomes an intermediate type between the pure jet and the turbine-airscrew. Installed weight of the complete plant is approximately 2,250 lbs. and the total output, jet and fan, is 4,710 lbs. at the take-off. For the climb at 200 m.p.h. to 20,000 ft. the specific fuel consumption is 0.661 lb./H.P./h. whilst the rate for continuous cruising at 400 m.p.h. at 20,000 ft. is 0.87 lb./H.P./h.

The rate of fuel consumption is of primary importance for ultra-long ranges of operation and for this purpose many advocate the compounded power plant. In this a highly-supercharged Diesel engine is employed as a dynamic generator of gas for the turbine.



Drawing of projected Bristol " Theseus " gas turbine-airscrew engine ; aft of the turbine is the heat exchanger for pre-warming air from the compressor.

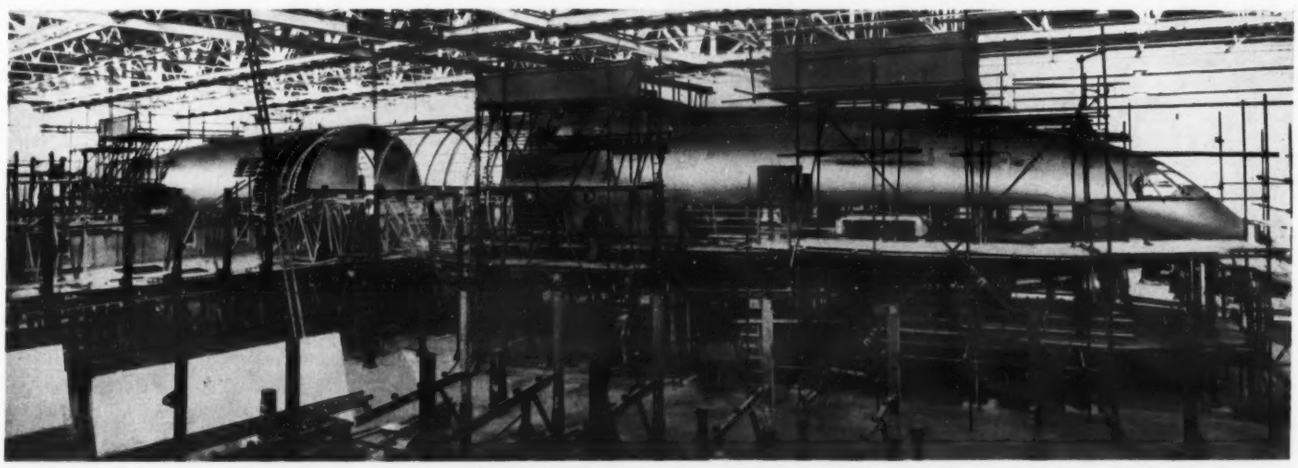


Armstrong Siddeley " Python " gas turbine-airscrew unit on test bench.

Power at the engine shaft is completely absorbed in driving the super-charging compressor and the useful power to drive the airscrew is obtained from the exhaust gases by the turbine. Fuel consumption rates as low as 0.33 lb./H.P./h. are confidently expected. Naturally specific weight is much greater than for turbine-jet or airscrew units but in a large craft the saving in fuel can redress the weight factor in a few hours' flying. For example, in one projected installation six compounded units would have twice the weight of twelve turbine-airscrew units, but this extra weight is recovered in only four and a half hours' flying.

Our most ambitious landplane is the Bristol 167, a 132-passenger leviathan having a wing span of 230 ft. and weighing 145 tons, which is destined for the trans-Atlantic service ; an aerial counterpart of the famous ship, " Queen Elizabeth ". Three have been ordered and the prototype, expected to fly this year, is being fitted with eight double-row, sleeve-valve piston engines, geared in pairs to drive

132-passenger Bristol 167 trans-Atlantic air liner of 145 tons.



four contra-rotating airscrews. Subsequent models, however, will be powered by eight " Proteus " turbines, also geared in pairs. A feature is that each turbine and its airscrew will be capable of independent operation if desired.

Saunders-Roe have under development a huge flying-boat, the S.45, of 220 ft. span and 120 tons total weight. Three are on order and undoubtedly they will be powered by six turbine-airscrews, possibly Rolls-Royce " Clyde " or Armstrong-Siddeley " Python " units.

One version of the 42-ton Handley-Page " Hermes " liner for 64 passengers will be fitted with four Bristol " Theseus " turbine-airscrew units and is expected to cruise at 350 m.p.h. at 30,000 ft.

Shorter range craft are the 19-ton Vickers V.C. 2 and the 17-ton Armstrong-Whitworth 55, each powered by four turbine-airscrews. Rolls-Royce " Darts " will give the V.C.2 a maximum speed of 330 m.p.h. whilst the A.W. 55 will cruise at 280 m.p.h. on Armstrong-Siddeley " Mambas ".

Even feeder line types will change to turbines. The Miles " Marathon " and the De Havilland " Dove ", both at present flying with piston engines, are scheduled for conversion. A.S. " Mambas " will be fitted in the " Marathon " and a new, smaller De Havilland turbine unit is being produced for the " Dove ".

Most interesting is the projected De Havilland 106, a tailless, jet-propelled craft of about 38 tons all-up weight to cruise at speeds in excess of 500 m.p.h. Experimental flying for this design is being carried out on the D.H. 108 tailless, single-jet type which has a swept-back wing.

Another jet-propelled craft of advanced design is the Saunders-Roe flying-boat with two Metropolitan-Vickers F.2/4 jet units mounted side by side in the hull. Intended primarily for naval service, it has an overall length of 50 ft. and a wing span of 46 ft. and, it is claimed, will reproduce the performance of a conventional land-based fighter.

This imposing list of new turbine-propelled craft by no means exhausts the account of British activity. Including purely military types there are many more flying, under development, or in the design or project stages.

Saunders-Roe flying-boat powered with two Metropolitan-Vickers F. 2/4 jet-propulsion engines.

At the present time, in the very beginning of a new era in air transport, change is apt to succeed change with disconcerting rapidity and one is reluctant to indulge in prophecy. Nevertheless, it is not without interest to speculate on the possible types of civil air liners for the succeeding phase. The aircraft designer is no longer held in check by lack of suitable power units. He may, in fact, be assisted in his efforts to reduce drag by the turbine which requires a prodigious quantity of air and can be employed to effect a substantial measure of boundary layer control. Providing axial-flow compressors are employed to keep down the overall diameter, the unit can be held to very slim proportions and either completely embodied in the wing form or installed with the minimum protuberance.

Long-range air liner project with gas turbines driving contra-rotating airscrews.

All-wing air liner project for high speeds at high altitudes.

Wartime research on high-speed aircraft showed that the onset of compressibility phenomena could be delayed by the use of a swept-back, or alternatively a swept-forward, wing and it is probable that one or the other shape will be featured. It may confidently be presumed that pressurisation of accommodation space will be of proved reliability and that practical methods of boundary layer control will be available. Liquid rocket motors may be employed for take-off and for emergency bursts of power.

The accompanying illustrations are specially-prepared artists' impressions of possible future types based upon modern trends of thought. One shows an " arrowhead " tailless liner of 120 to 150 ft. span and powered by four gas turbines, each developing 3,000-4,000 H.P. and driving contra-rotating pusher airscrews. This project is intended for medium speeds at medium altitudes.

For a craft of greater size and in which the accommodation as well as the power units can be embodied within the wing form, an " all-wing " type is suggested. Intended for operation at high altitudes and speeds of the order of 500-600 m.p.h., propulsion is by a plurality of large turbine units producing pure jets. Undoubtedly, this will be a somewhat later development.

New American navigation systems

Navaglobe, Navar, Navaglide, Navascreen, LANAC

By G. GUANELLA and H. SCHAFROTH.

There is no denying that present-day radio navigational aids are no longer able to cope with the incessant increases in air traffic, particularly in the European region. Whereas various new systems, developed during the war, manifest a high degree of efficiency in certain fields of navigation, they lack an element which is indispensable to the airlines, basic co-ordination ; this because the urgency of victory required that problems be segregated and treated individually. At the moment only America can boast a comprehensive navigational organisation for long-range flying, but even this is now obsolescent. (It will be recalled that MF-Radio Ranges are installed along U.S. continental airways.) Most of the navigational aids used in Europe were already installed before the war, though it should be pointed out, on the other hand, that a number of the Gee chains and Consol beacons used during the war, are still operating. Though modern, these installations cannot be utilised fully as the appropriate airborne equipment is in insufficiency. Another impediment to their co-ordinated use is the decision by PICAO so far to adopt the SCS-51 Instrument Landing System only. [1]

A comparison between the navigational systems formerly used, and the new ones, broadly outlines the following picture :

In the old navigational systems the determination of a fix was effected mainly by *ground-assisted bearing-measurements.*

The present tendency is to design navigational systems capable of working *without ground-crew assistance*, thus enabling a fix to be determined by means of distance-indications, time-indications (Consol), or bearing-indications. The great advantage of navigation without ground-crew assistance is that an almost unlimited number of planes can simultaneously carry out a fix by making use of the same ground-beacons, and thus unburden the ground crews. For this reason PICAO recommends the introduction of navigational systems which permit navigation en route, in approaches, and instrument-landing without the assistance of ground control.

A description of a few of the most characteristic systems will serve to give an idea of the directions in which development is being pursued in the U.S.A. It is possible that one or the other of these systems will be discussed more thoroughly in a later issue.

Navaglobe, Navar, Navaglide and Navascreen [1]

Prompted by the deficiency of air navigational aids, Federal Telecommunications Laboratories, Inc., of New York, began 2½ years ago to develop a series of systems which were to solve the problems presented by the growth of air traffic. These systems were to incorporate possibilities for improvement as new problems arose. Following discussions with the armed forces and airline companies, Federal concluded that the following main problems had to be solved :

(a) The problem of guiding planes over oceans, jungles or other desolate regions.

(b) The problem of guiding planes over inhabited regions which can be provided with radio ranges or other navigational aids.

(c) The problem of navigation in the vicinity of airfields, where heavy traffic concentration makes special demands on traffic control.

(d) The problem of bringing a plane down safely and on the desired runway during instrument weather.

The systems described below do not provide an accurate solution to these four problems, since Federal was of the opinion that a solution to the problem of navigation over inhabited regions *(b)* is sufficiently well provided for by the use of VHF-omni-directional beacons and radio ranges.

Navaglobe, Navigational System for Trans-continental Flights

In the above-mentioned discussions between the armed forces and airlines it was concluded that the three most important requirements of a long-range navigation system are :

(a) 100% reliability over the rated coverage-area at all times of the day and night and in all seasons of the year.

[1] "Interavia, Review of World Aviation", N° 8-9, Nov.-Dec., 1946, P. 63.

[1] "Electrical Communication", June, 1946, P. 113-143.

(b) A rated minimum coverage so large that every travelled portion of the earth may be covered by two stations without construction of artificial islands.

(c) Airborne equipment for checking indications given by the system.

From these conditions it is obvious that the first consideration is a guarantee that fixes can be provided at any time and any place on earth. Demands regarding weight accuracy, cost, simplicity of operation, etc., are considered of secondary importance. On long-distance flights it really does not matter if a plane deviates 10, 20 or even 100 miles from its course, provided that it reaches its destination safely.

Research on the Navaglobe system began with a systematic geographical study of the globe to find out the minimal radio-range necessary to comply with the demands mentioned under *(b)*.

It was concluded that, with a radio range of 1,500 miles, 60 stations would be needed to cover all oceans. To cover the continents (with the exception of the Antarctic region) 15 extra stations would have to be added, so that a total of 75 stations would suffice to serve the entire globe.

Next, a suitable wavelength equal to the demands mentioned under *(b)* had to be found. It was seen that a frequency of over 70 kc/s would achieve a degree of reliability in excess of 99%, provided that the receiver-bandwidth could be narrowed down to 10-20 c/s. The input-power requirements of the stations would amount to 7-25 kW in the temperate zones and up to 100 kW in the tropics.

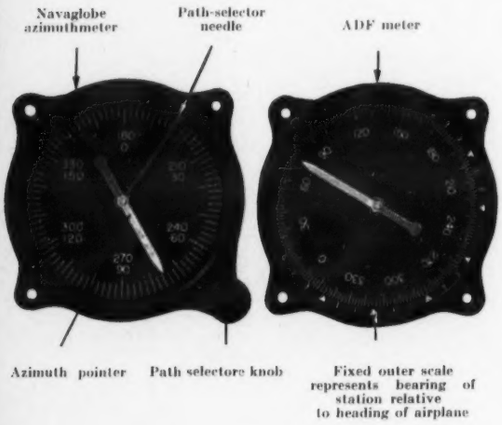


Fig. 1:
Navaglobe Indicators

With an antenna efficiency of 60% the radiated energy would, therefore, amount to 4.2-60 kW during adverse conditions, while only $^1/_3$ to $^1/_4$ of this power would be needed for the rest of the time.

The Navaglobe transmitter is a low-frequency OW omnidirectional beacon, signals of which are received in the airplane on a narrow-band receiver with a loop antenna. The receiver operates two meters (Fig. 1), one of which, the azimuth-indicator, works on the omni-directional range principle and shows the azimuth, while the other provides normal ADF. The azimuthmeter shows the angle from the ground station to the plane, while the Automatic Direction Finder indicates the true bearing from plane to station (Fig. 2).

As the ADF meter normally indicates the angle from plane to station, γ, the rotating inner scale of the ADF meter (Fig. 1) must be coupled with a suitable gyrosyn compass. In this way the ADF meter shows the angle β, while the angle α can be read on the azimuthmeter.

As may be seen in Fig. 2, $\alpha = 180^o + \beta$. Hence, it is possible to check the azimuth indication with the one on the ADF meter, or vice versa. To facilitate this control the 360° on the azimuthmeter are divided into two revolutions, so that a reading of β may likewise be taken.

Since both instruments are fed by the same receiver it could be assumed that they are both subject to the same errors, thus making a reciprocal check impossible. This, however, is not the case: ADF errors originate in faulty polarisation while azimuth-indication is mainly troubled by reflections. If, therefore, the two readings are not in consonance and not in accordance with the description, the navigator knows that this indicates an error.

The Navaglobe can also be used to fly any range-leg, since by a suitable adjustment of the path-selector needle (Fig. 1), a " fly-right " or " fly-left " signal can be taken from the receiver and applied to a standard cross-pointer or even directly to an auto-pilot.

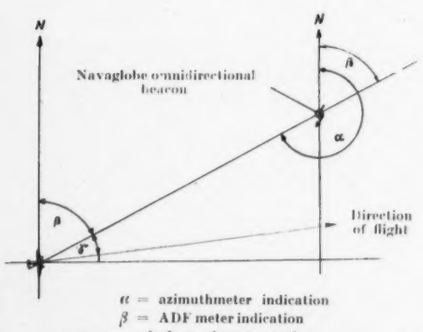


Fig. 2: Navaglobe Long Range Navigation

Navar, System for Traffic Control in the Airport Zone.

Comprehensive traffic control in the vicinity of airports is regarded by Federal as one of the most important and urgent necessities. In the development of the Navar system, which is to satisfy these demands, the decisive factor was again to design sets which later would allow for suitable extension to meet with increased operations.

To satisfy the most urgent needs Federal Telecommunications Laboratories intends to fit ground control stations with conventional surveillance radar incorporating PPI-Indication (Fig. 11), which makes it possible for the controller to identify any planes in the airport zone by their relative position to the control tower. As, however, a radar set of this kind can easily jam (by reflexions, ground clutter, etc.) a so-called responder is provided for planes flying in bad weather. As the radar beam passes over the responder, the latter " responds " on a new frequency which acts upon a further PPI-indicator (Navascope) on the ground. As the field strength of the answering signal is far greater than that of a normal radar reflexion, a clear PPI-indication is received, which, on account of the different frequencies, cannot be troubled by reflexions. A special apparatus on the ground receiver enables a determined altitude layer to be selected so that on the Navascope, for example, only planes flying between 2,500 and 4,000 ft. are shown. Switching on of a layer-selector makes planes in other altitude layers visible (*e.g.:* from 1,000 to 2,500 ft. or from 4,000 to 5,500 ft.).

In this way the Navar station on the ground can obtain 3 PPI-indications, representing " member " airplanes (with beacons tuned to local control), " guest " airplanes (with beacons tuned to another channel, merely passing through the local area) and " strangers " (planes without beacons). The Navascope picture for " members ", and " members " plus " guests ", is provided by operation of a switch, which obtains one or the other representation.

It is intended to superimpose the Navar and radar pictures on maps of the local areas (Fig. 3) in a manner that the radar picture appears in yellow, the Navar pictures in red and the map in black.

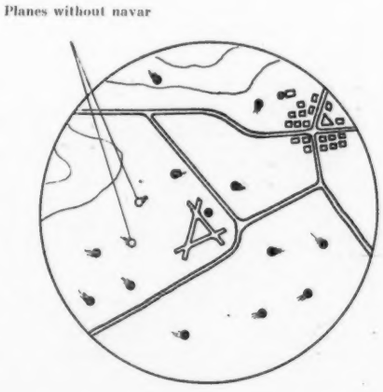


Fig. 3:
Radar Screen with Superimposed Map

In consequence, it is possible for the controller to undertake the following controls :

(a) Determination of the position of planes desiring to land on the airfield (" members ").

(b) Determination of the position of planes fitted with Navar sets and flying within a radius of 60 miles of the airfield (" guests ").

(c) Determination of the position of planes without or with inoperative equipment, in the vicinity of the airfield (" strangers ").

(d) Determination of the air traffic at any determined altitude layer.

Furthermore, it is intended to improve the system in such a way that a corresponding adjustment of the control receiver will result that any " member " plane can be isolated on the Navascope and put in touch with it. Replying to a special ground-signal, the responder will, for instance, automatically give information on the plane's identity and altitude without assistance of the crew.

It is foreseen that information supplied to the airplane be limited at first to azimuth and distance (Fig. 4). While azimuth indication is based on the omni-directional range principle, distance indication is provided by pulse-timed radar. The latter function can be carried out by the responder.

A further development stage projected is to give the pilot a visual display duplicating the PPI-picture of the ground Navar. It is suggested that the ground station re-broadcast the video-input signal to the airplane, where it would be fed directly into a PPI-Navascope. To avoid an overcharge of the picture all indications of planes at 800 ft. above and 800 ft. below flying altitude of the receiving aircraft are suppressed by a " layer-blanking " device. The thickness of the controller layer can be altered as the pilot wishes.

A supplementary instrument, the Offset Path Selector (Fig. 4), allows for accurate orbitting with a set radius and the ground station as centre point of the orbit. With this instrument it would be possible, for instance, to group planes flying on the same altitude, but on different orbits, round a marker beacon. The present practice is to " stack " aircraft around a marker beacon. This method, however, entails various shortcomings : for example, a plane could inadvertently be allocated a level where icing prevails.

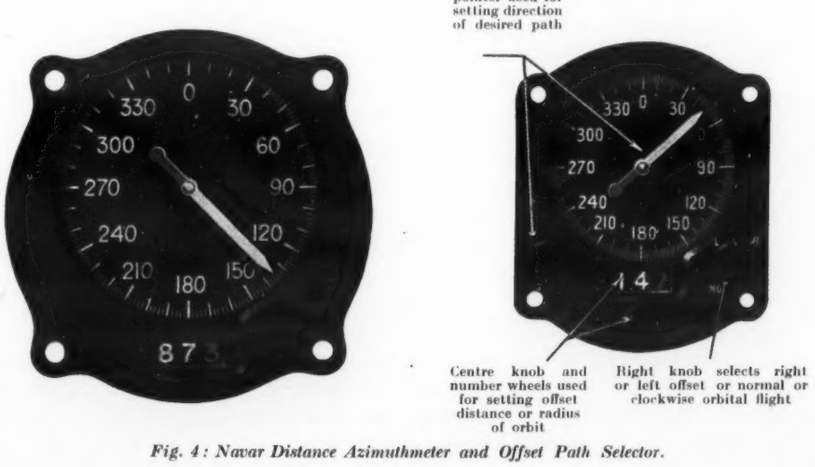

Left knob and pointer used for setting direction of desired path
Centre knob and number wheels used for setting offset distance or radius of orbit
Right knob selects right or left offset or normal or clockwise orbital flight

Fig. 4 : Navar Distance Azimuthmeter and Offset Path Selector.

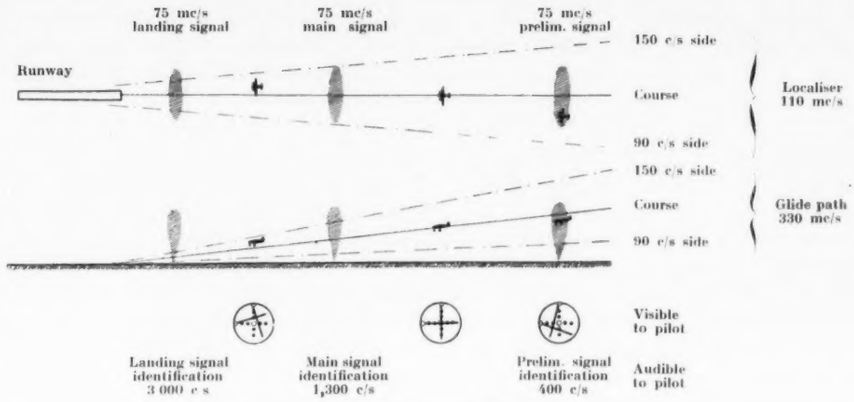


Fig. 5 : SCS-51 Instrument Landing System.

Navaglide Instrument Landing System.

This system concerns a development of the SCS-51 instrument-landing system used during the war and now adopted by PICAO. As Federal opines that the latter will prove adequate for a number of years to come, a brief description thereof is indicated.

The SCS-51 consists of a localiser transmitter, a glide-path transmitter, three marker-beacons on the ground and three corresponding airborne receivers. The localiser transmitter, acting on a directional antenna system consisting of 7 radiation elements, generates two 100% horizontally-polarised intersecting field patterns, one of which is modulated at an audio-frequency of 90 c/s, and the other at 150 c/s. In a similar manner, the glide-path transmitter produces two intersecting vertical field patterns, one of which is modulated at 90 c/s and the other at 150 c/s. Transmitting frequencies are 110 mc/s for the localiser and 330 mc/s for the glide path. Any deviation in course of an aircraft approaching the runway will produce " fly right ", " fly left ", " fly higher " or " fly lower " signals (Fig. 5), as the case may be. Automatic instrument landing to within about 15 ft. of the runway can then be achieved by coupling these signals to the automatic pilot.

The three marker beacons, operating on a frequency of 75 mc/s, are installed in the conventional manner as outer, middle and boundary markers. Accurate function of the localiser and glide-path systems is constantly controlled by monitoring equipment. A shift in the localiser or glide path course, or a complete break-down, produces oral and visual alarm signals in the control-tower.

In the Navaglide system only one transmitter, working on a microwave-frequency, is necessary to provide the localiser and glide path field. It is the principle of " time-sharing " (wherein the four course signals —up, down, left and right—are transmitted in rapid succession rather than simultaneously) which enables the use of one frequency only. The extremely narrow beam-width made possible by microwave frequencies allows reflexions caused by ground elevations, railway lines, etc., to be reduced to a minimum.

Navascreen.

A further system designed by Federal projects all available information relative

to aircraft movements (flying altitude, position and direction) on a semi-transparent screen set up in a darkened room. Dividing the room into two parts, this screen is actually a scale map of the airport area. The sources of information comprise the radar and Navascope indications and the position reports obtained by telephone, telegraph, teleprinter, etc. In the Navascreen system, small searchlights project all received indications in suitable form on to this screen ; the identity mark of each plane lights up at the corresponding point on the map together with an arrow indicating the direction of flight. The " aided tracking " principle enables these luminous signals to be synchronised with aircraft movement information. To transmit indications relative to altitude, specified colours are used for the letters and the arrows : for instance, a colour scheme could involve a colour for letters indicating thousands and one for arrows to mean hundreds.

The camera obscura principle makes it possible to reflect the screen back and superimpose it on the Navar or radar scope, consequently giving the operator a means to check and ultimately to adjust the synchronisation. It is reckoned that one controller can synchronise the movements of as many as six aircraft.

As the screen divides the control room into two parts, one part can be used to contain the Navar and radar scopes, telephones, teleprinters, etc., together with the operating staff, while in the other part of the room the traffic-controllers can quietly follow the traffic on the screen, and radio their instructions to the aircraft.

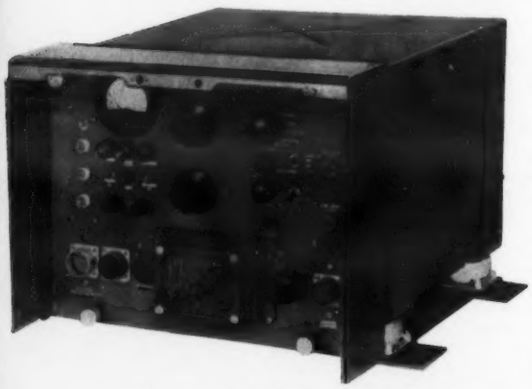


Fig. 6 : Ground Challenger (small model).

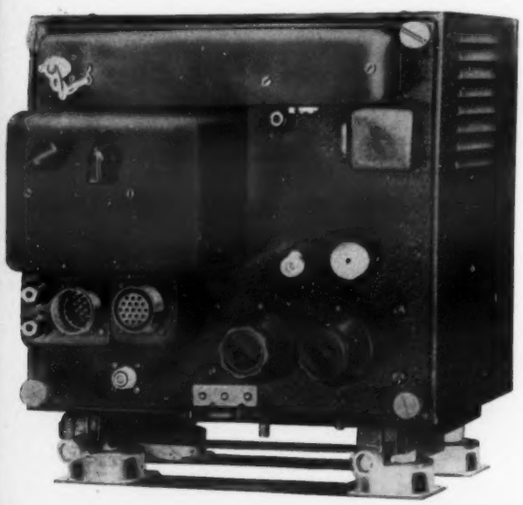


Fig. 8 : Airborne Replier : pulse power, 500 watts ; Frequency, 1,000 mc/s range.

LANAC.

The LANAC (LAminar Navigation and Anti-Collision) system developed by the firm of Hazeltine, in New York, embraces navigational aids for continental airways as well as anti-collision and airport traffic control systems. All the functions of the LANAC equipment are fundamentally executed by two sets with the aid of various forms of antenna and cathode-ray tube. Since repeated reference will be made to these, it is fitting that a brief description be given of the equipment as well as of the radar pictures and their production.

The first of the LANAC sets is the *challenger* (Fig. 6 and 7), a radio set consisting of two components. One component comprises a transmitter with a coder which can be switched over either manually or by means of an aneroid barometer. The transmitter works on a pulse-timed radar principle, *i.e.*, it generates very short pulses (1 sec. duration). According to how the coder switch is set, the transmitter is triggered with pulse pairs at 3 to 35 sec. intervals, whereby the intervals are selected in accordance with specified codes. As the duration of the pulses and intervals is extremely short as compared with the duration of morse signals, transmission can be superimposed by any text in morse without effecting the coding. — An omni-directional antenna is used for radiation by the challenger.

The second component consists of a receiver with a directional antenna, which is coupled to a cathode ray tube. The form of the antenna depends, as described below, on the way the cathode ray tube is used.

The second LANAC set is the *replier* (Fig. 8), like the challenger, a radio set consisting of a receiver and a transmitter which, however, do not operate independently of one another. The receiver picks up signals arriving on a corresponding frequency, which are amplified and conducted to the decoder. As previously, the latter can be adjusted to a determined coding either manually or by means of an aneroid barometer. Provided this coding is correctly adjusted, the signals are decoded (by the decoder), passed to the transmitter and sent out again on a new frequency. In addition, a supplementary apparatus, known as an identity coder, keys the transmission with the characteristic morse signal of the replier's station.

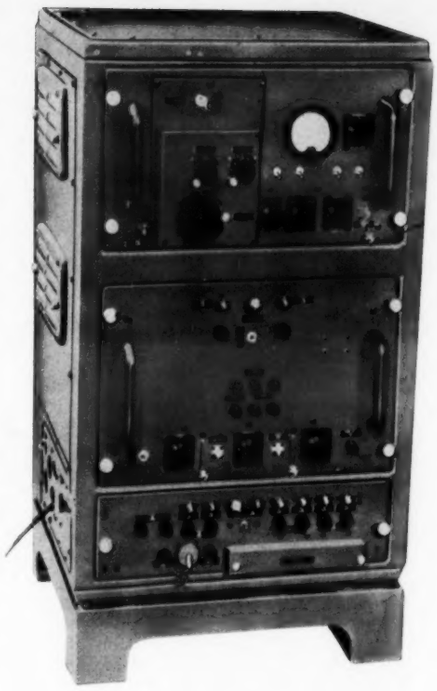


Fig. 7 : Ground Challenger (big model) : transmitting pulse power, 8,000 Watts ; Frequency, 1,000 mc/s range.

The decoder can be adjusted to react to several codes (emergency, obstacle warning). Furthermore, reflected pulse are allocated corresponding identity signals. In emergencies, the SOS sign is added to the identity signal.

The three principal applications of the radar cathode ray tube, briefly mentioned below, are designated A, L and PPL-Display.

A-Display is the common radar display which plots distance along a horizontal axis and signal-intensivity vertically (Fig. 9). The system works with a directional antenna, in this case with a rather broad beam.

L-Display consists of a cathode-ray tube and two directional antennæ with overlapping lobe patterns (Fig. 10). This permits the distance to be measured to objects located within a broader antenna beam than that of the A-Display. As the antenna on the left is used to deviate the cathode ray towards the left, and the right-hand antenna to direct it to the right, the arrangement makes it possible to say whether the object is on the left or right, relative to antenna direction. The principle incorporates an automatic switch which rapidly shifts the challenger from one antenna to the other.

PPI-Display consists of a cathode-ray tube which renders signals from a revolving radar-beam visible (Fig. 11). When the

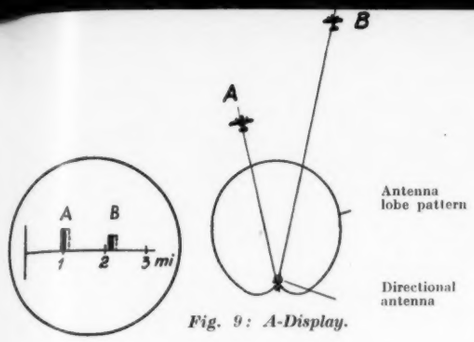


Fig. 9: A-Display.

beam touches an object a reflexion or a return message from the replier is produced, which results in a deviation of the cathode ray proportional to the distance of the object. As in the moment of the reflexion the azimuth is fixed by the direction of the radar beam, the objects appearing on the screen in the shape of illuminated dots are accurately represented as regards azimuth and distance.

For the moment this kind of display cannot be installed in aircraft on account of the complexity of the antenna structure.

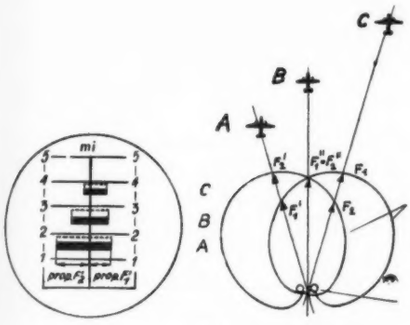


Fig. 10: L-Display

For efficient navigation with the LANAC system, the network flown must be furnished with a sufficient number of LANAC beacons (repliers, Fig. 8), and the plane provided with a challenger. If the pilot switches over to a selected ground beacon, his transmitter radiates correspondingly-coded pulses. The replier, with corresponding frequency and coding, returns a new signal on a frequency different from that of the received signal. This is received by the challenger and used for pulse-method distance-measuring. If the plane is provided with a corresponding rotatable directional antenna, a bearing can be taken as well as a distance measured. If greater bearing precision is desired, to determine the ground speed, for instance, this can be achieved by measuring the distances between the plane and two LANAC beacons (Fig. 12 *b*).

It is clear that when a bearing is being taken, only that replier selected by the pilot may answer. By using several frequencies, 46 different combinations are possible.

In instrument weather the LANAC *anti-collision* system points out to a pilot any plane which, in relation to distance and bearing, constitutes a danger of collision with his own machine (Fig. 10) ; provided, of course, that all planes on the network are equipped with LANAC challengers and repliers. The challenger constantly sends out a coded signal, which is received by any planes within reach of the challengers' transmission range. Meanwhile the code depends on the latitude layer (Fig. 12 *c*) in which the aircraft is flying, since the aneroid automatically switches over the coder, or the decoder, during passage from one altitude layer to another. Hence, these signals are only answered by aircraft flying in the same altitude layers. The replier's message is in the form of a distance indication on an L-Display (Fig. 10), and is always keyed with the identity signal of the answering plane, with the result that the cross-line produced on the L-Display widens and narrows in timing with morse signals.

The same system can also be used to indicate ground obstacles (Fig. 12 *d*). The replier is adjusted to react to messages from all planes flying below the peak of the obstacle (taking into account a specified safety margin) and disregards all aircraft flying above this altitude.

The LANAC challenger can be employed in accordance with the conventional radar method, whereby the pilot should tune the receiver to the same frequency as the transmitter so that echoes can be picked up and recorded on the challenger's display. This method is indicated for areas in which obstacles are not fitted with repliers. For indicating the presence of other aircraft, however, this method cannot be used, as a signal reflected from such a small target as an aeroplane would be far too weak ; a

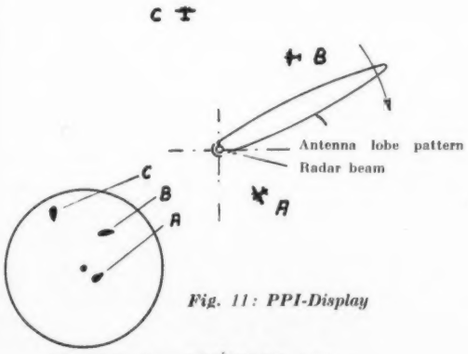


Fig. 11: PPI-Display

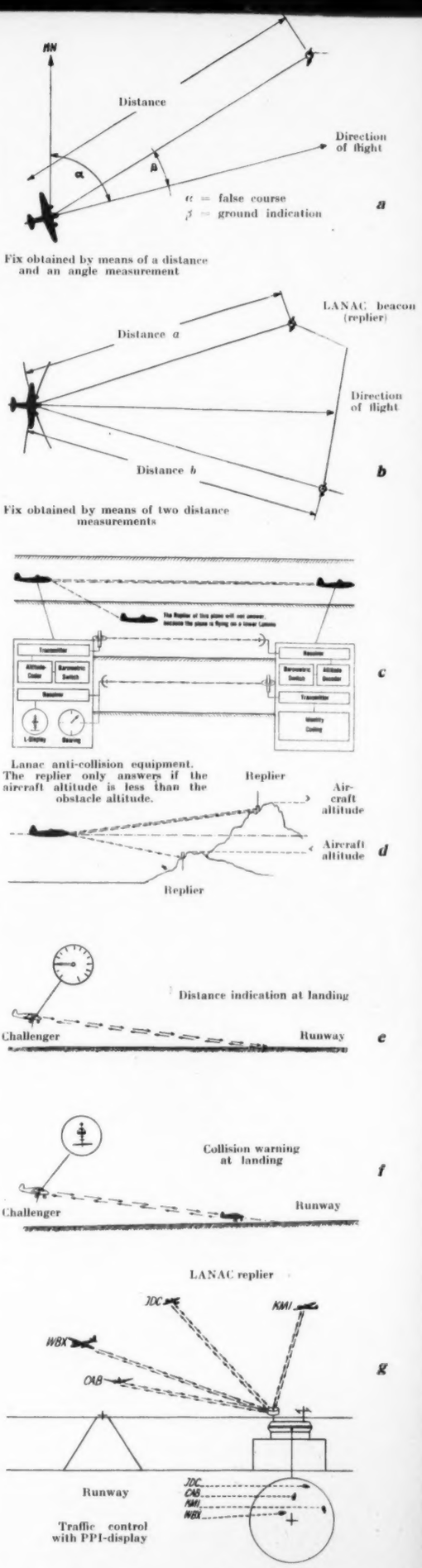


Fig. 12: Representation of the Principal LANAC Functions.

sufficiently strong signal would only be obtained if the approaching aircraft were in the immediate vicinity, at which moment it would probably be too late to avoid a collision. The range of pure radar, as regards its use in aircraft, amounts to only 5 to 10 miles, while LANAC equipment reaches ten times this distance. A further disadvantage of ordinary radar is that its signals are easily troubled by parasitic reflexions. This cannot occur in the LANAC method since the frequency on which a signal is returned is different from that on which the challenger emits its signal.

For *airport traffic control*, the control tower can be equipped with a LANAC system (Fig. 12 *g*) working in conjunction with a PPI-display (Fig. 11). The immediate air space is constantly checked by the radar beam so that any aircraft in the vicinity are immediately indicated by luminous dots on the PPI-display. The challenger can be coded to cause either all planes with repliers to answer, or else only those located in a specified altitude layer. It is intended to use only one PPI-display for small airfields, but larger ones are to be fitted with a display for every altitude-layer. On small airfields the traffic controller would constantly have to check layer after layer, while on large airports there would be a traffic-controller for each altitude layer.

A directional antenna in the control tower, coupled to a challenger with an L-display, serves to identify odd planes. If this antenna is directed towards a certain plane, the latter will automatically send back its identity and the L-display will immediately indicate the distance.

By equipping the airways with sufficient radio stations, it is still possible for planes flying outside the control areas of airports to contact the control towers. Such a station comprises a challenger connected with the airfield tower either directly by a cable or else by radio, and is available to any aircraft irrespective of altitude.

Fig. 13:
LANAC Ground Directional Antenna.

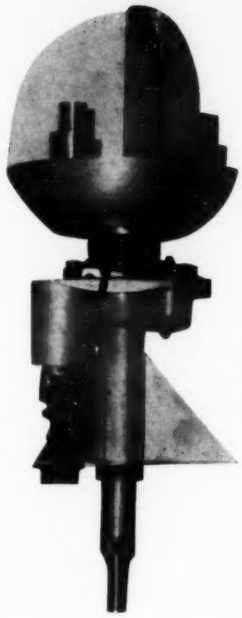


Fig. 14:
LANAC Airborne Directival Antenna (Streamline cover removed)

* * *

As already stated at the beginning, radio navigation in the U.S.A. is in a state of transition and shackled by the usual concomitant symptoms. Whereas the present installations are unable to meet the demands imposed by the growth of air traffic, there all the same exists a wide variety of new developments, most of which, however, are not yet in the operational stage or else not available. This makes it difficult to select those most suited, and a satisfactory solution must necessarily involve comprehensive co-ordination ; but it is doubtful, at least for the moment, whether this can be achieved. Though there is no denying that in having to choose navigational aids for international adoption, PICAO is faced with an extremely difficult and delicate task, it is to be hoped that this body will lose no further time in publishing directions and instructions concerning the systems to be introduced. An ideal system would comprise a combination of simplest possible airborne equipment with a maximum number of functions (long and short-range navigation, anti-collision equipment, instrument-landing and radio-telephony or telegraphy). In order to avoid piece-meal introduction of various systems, which would inevitably result in a multiplicity of airborne equipment, it would be for the industry right now to initiate a co-ordination such as was featured in U.S. industry during the war. Since it is evident that co-ordination of this nature would have to contend with almost insuperable obstacles, PICAO will probably have to provide a half-way solution and achieve the best possible selection and combination from the systems available. Such combinations, which would require close study before introduction into Europe, could, for example, embrace : Navaglobe, Gee, Navar and SCS-51 ; or Gee/Loran, LANAC and SCS-51 (Gee/Loran interchangeable for short and long routes).

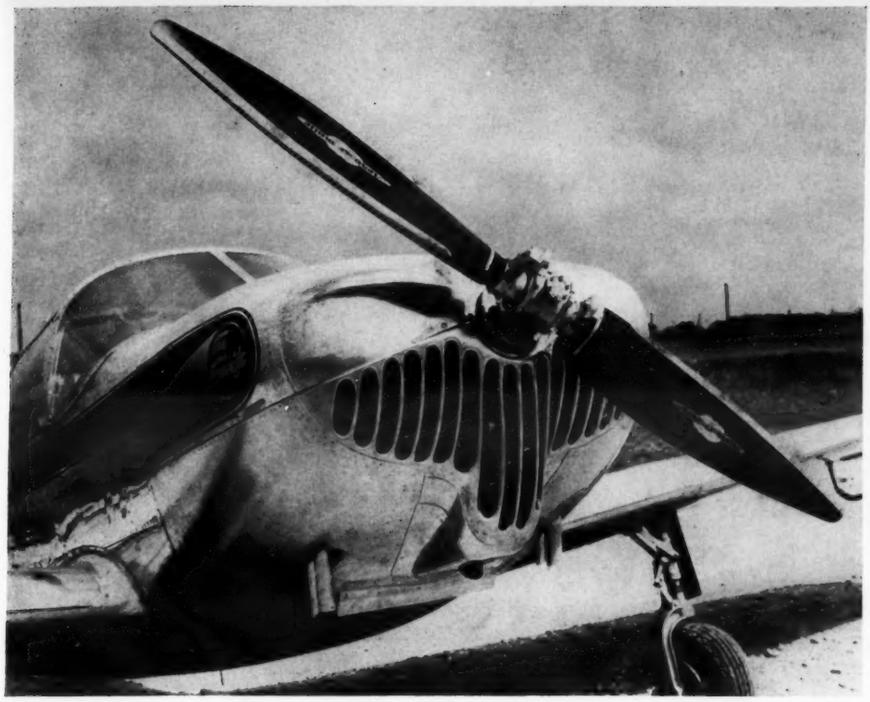


Fig. 1
A view of the Globe "Swift" two-seater tourer fitted with the Aeromatic F-200 propeller

The "AEROMATIC" Propeller

Its Design and Manufacture

By Paul F. HACKETHAL, Chief Engineer, Koppers Company, Inc., Baltimore.

The "Aeromatic" propeller embodies the development of a variable-pitch propeller in which the blade pitch change takes place automatically without any manipulation of controls by the pilot. These pitch changes will follow a predetermined pattern which is maintained by so arranging the propeller assembly that it will respond to the varying physical forces acting upon it. It is manufactured by the Bartlett Hayward plant of Koppers Company, Inc., Baltimore, by licence of the Everel Propeller Corp., the earliest automatic propeller research group in the U.S.A. Externally it differs very little from conventional propeller construction. When considering its operation, however, certain uncommon requirements in regard to design and manufacturing become evident.

For best performance an airplane requires that the propeller-engine combination deliver the maximum desired thrust under all flight conditions. The available power from the engine will largely determine this propelling thrust, and the amount of this power is dependent again largely upon the rotative speed of the engine. However, the engine speed is subject to limitations which are imposed by the engine manufacturers to insure endurance and reliability. It was one of the objects, when developing the "Aeromatic" propeller, to assure that not only the propeller itself would be reliable, but that its pitch variation should at all times restrict the operation of the engine to the speed range and power output established as safe by the engine manufacturer, and that it should do this automatically.

For instance, the low pitch blade limit stop is so adjusted that the engine, during take-off and climb, will be able to speed up only to the maximum specified RPM, regardless of throttle opening. No manipulation of engine or plane controls by the pilot will decrease the pitch and, thereby, overspeed the engine. Likewise, in a dive the engine will stay within rated RPM as long as the placard diving speed established by the plane manufacturer is not exceeded.

Another instance where reliability of instantaneous propeller response is most essential may occur when the pilot overshoots the landing field. In this case, giving full throttle, the blade swings automatically into low pitch position, allowing the engine to develop the same RPM as during the original take-off or climb condition.

The range of pitch change is predetermined for each type of installation and depends largely upon the speed of the plane. In certain cases, such as bi-motor installations, the range may be greatly increased on the high pitch side to reduce the propeller blade drag of a dead engine, as the blades will automatically move toward the feathering position, limited only by the adjustment of the high pitch stop screw.

The operation of the pitch changing mechanism depends upon the establishment of equilibrium between the *aerodynamic moments* which tend to *decrease* the pitch of the blades, and the summation of the blade and counterweight *centrifugal moments*, which tend to *increase* the pitch.

It is obvious that the propeller action must be so sensitive that the slightest difference between these two opposing forces will be sufficient to cause the propeller to respond to variations in altitude and power absorption without any time lag. This sensitiveness obviously requires a minimum amount of friction in all moving parts of the propeller, such as especially designed bearings, low friction type of shaft packings and proper lubrication. In fact, friction must be so low that its quantitative value may be neglected in the calculation of pitch-change forces.

Hub Construction.

The hub itself was designed to obtain a low weight and to reduce manufacturing cost. The various stages of producing this hub are shown in Fig. 3. The main hub barrel "A" is made from steel tubing, finish machined on the outside and partly machined on the inside. Likewise, a cross-tube "B" has been finished on the outside and rough bored on the inside. Both pieces are then pressed together and welded. Short pieces of steel tubing are assembled on the bosses which were previously machined on the

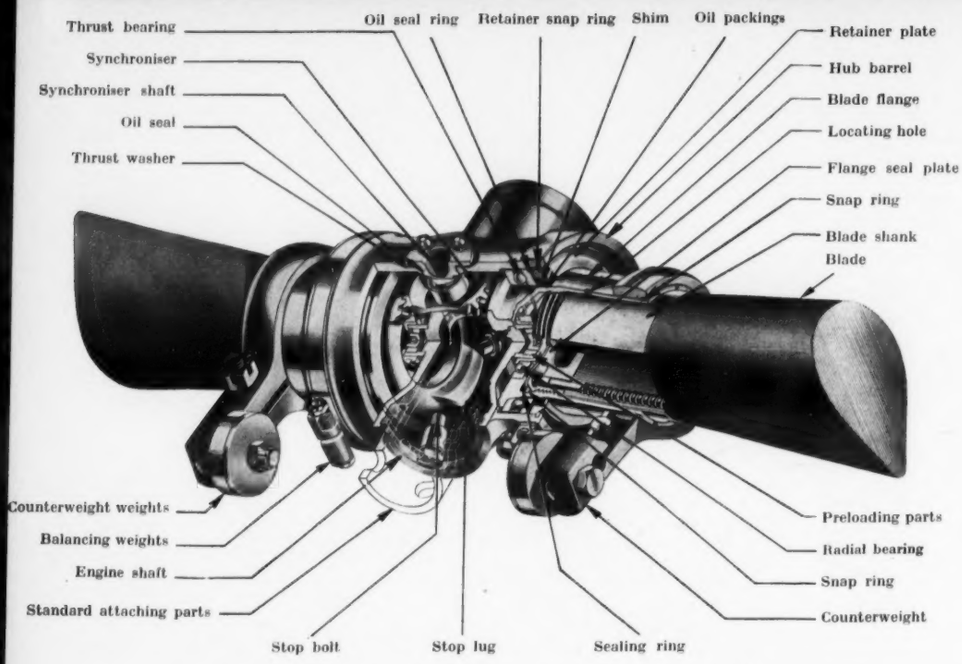


Fig. 2: Hub of the Aeromatic F-200 propeller.

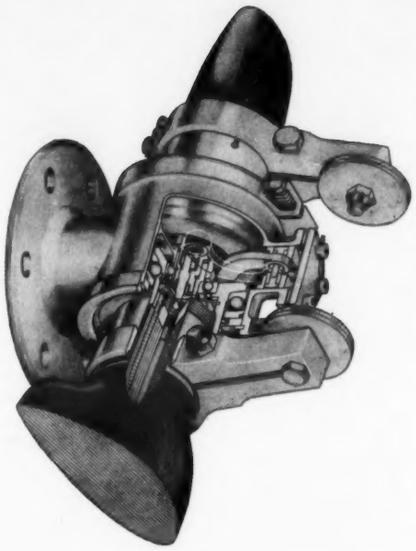


Fig. 4
Aeromatic F-200 propeller hub for flange shaft engines.

Fig. 3
Hub construction. A: Hub barrel; B: cross-tube prior to welding; C: finished hub.

cross-tube "B" and four short round bars are pressed through the sides of the barrel which will form the support for the blade stop adjusting screws. All these pieces are now welded together, heat treated and hand ground. The hub is then finish machined on the inside "C". By this method, expensive milling operations on the inside of hub and around the inter-section of cross-tube and hub barrel are eliminated. Maximum amount of unnecessary metal is removed at low cost. The hub weight for an SAE No. 20 spline propeller is thereby reduced to 12 lbs. For flange type engines a further reduction in weight is obtained by eliminating the crosstube. Such hub construction is shown in Fig. 4.

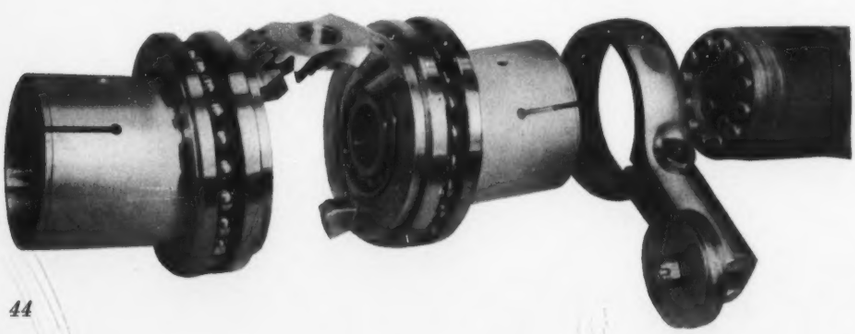
The blade flanges (Fig. 5) are mounted on anti-friction ball bearings in the hub barrel. They are provided with sockets into which the blade shank is anchored by buttress threads and clamped tight by the counterweight arm. The inner faces of the flanges are provided with gear segments which mesh with a bevel gear mounted on a bearing shaft in the hub, causing the blade flanges to rotate in synchronism. For flange type hubs (Fig. 4), covering a range of 65 to 150 H.P., the synchronising mechanism connects the flanges by short links to a piston which moves inside a cylinder mounted in front of the hub, assuring a synchronised oscillating movement of both blades.

The end play of the blade flange assembly in the hub barrel is taken up by a preloading device on the inner bearing support. This consists of the following parts: A flanged cap carrying the radial thrust bearing slidably mounted on the bosses of the hub cross tube and a screw sleeve mounted in the threaded portion of the hub bosses. By turning this screw sleeve away from the centre of hub, it will press against the cap and, thereby, preload the radial thrust bearing against the blade flanges. The sleeve is further provided with saw slots. A tapered pipe plug inserted into this sleeve expands the sleeve against the hub boss and, thereby, locks the preloading device. In the flange type hub, the locking of the preloading screws is accomplished by a serrated pin and lock-nut.

The flange and blade assembly is held in the hub bore by a retainer plate and snap ring. In larger models, using metal blades, the outer end of the hub barrel and retainer plate are threaded to hold the flange assembly in place.

Four small bosses, welded to the hub barrel, are tapped for the stop screws which

Fig. 5: Principal components of the Model 220 Aeromatic hub. Blade flanges with synchroniser gear in relative position; counterweight arm and weights in relative position to blade.



limit the angular rotational movement of the flange and blade.

Counterweight.

The various parts of the propeller must be so assembled in their relative position that equilibrium between the aerodynamic and centrifugal moments is maintained at the proper blade angle necessary for maintaining the desired performance at every instance of flight for a particular plane and engine combination.

To simplify such assembly adjustments and to make the same parts suitable for a wide range of applications, it was found desirable to provide means for modification of the mass distribution of the blade. This is being accomplished by the addition of a counterweight to the blade shank which can be varied in its effect by changing its angular position relative to the blade airfoil and whose magnitude may further be varied by increasing or decreasing the weight of the counterweight arm.

The counterweight is clamped around the outer end of the blade flange and, therefore, forms an integral part of the blade mass. By changing the angular position of this counterweight arm and by increasing or decreasing the weight attached to its outer end, the effect of the blade mass upon the regulation of the propeller may be varied to suit specific requirements. These alterations make it possible to use a standard airfoil blade design.

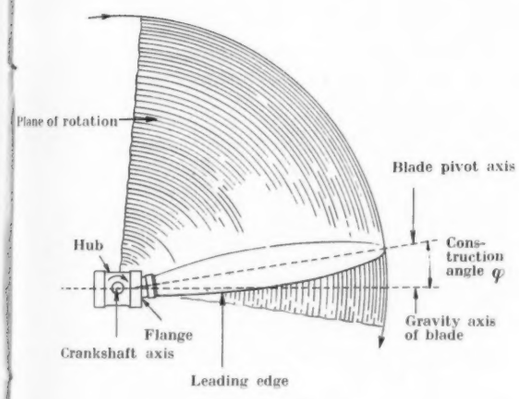


Fig. 7
Rear view of hub and blade, showing blade lag angle. Plan of rotation.

Propeller Blade.

In Fig. 6, progressive manufacturing steps of the "Aeromatic" blades are illustrated. The two parts " A " and " B " are copper-brazed and then finish machined as shown at " C " which represents the blade shank ferrule.

The blade block " D " is made from rotary-cut veneer laminations which are joined together by heat and pressure, using a thermal setting resin as binder between the individual sheets. To increase the stability of this mass, these sheets are splayed at alternate angles to the length axis of the blade. This also results in an increase of the torsional and shear physical properties of the wood, with no appreciable decrease in tensile strength.

This blade block is roughly cut out to a template on a bandsaw. The shank end as well as the centering cone on the tip end are then machined to the shape " E " on a special shank-turning lathe. The blade block and blade ferrule are now assembled and fastened together by wood screws. The blade block assembly is subsequently rough profiled and then finish carved to final dimensions within very close tolerance.

The surface of the finished carved blade is now treated with a liquid sealer. Afterwards, the whole blade is covered with a plastic sheet to protect the wood against the influence of atmospheric changes, thereby ensuring stability with respect to dimensions and weight. A tip and leading edge strip of Monel metal protects the blade against abrasion, dents, or cuts.

All blades designed for a specific engine-airplane combination must be identical dimensionally and equal in respect to total weight and weight distribution. The centre of gravity must be at a uniform location in three planes. To insure this accuracy, the span moment, face moment, and leading edge moment are checked and, if necessary, corrected to fixed values by inserting small lead plugs in the ferrule of the blade shank. The amount of such correction is determined on a special blade balancing scale. The profile dimensions of the blades must not be changed to achieve this balance as such change would alter the aerodynamic effects on the blades. This uniformity of blades insures identical pitch regulation between individual propellers of the same type.

Determination of Operating Variables.

The blade is screwed into the flange at an angle called the *construction angle* (φ). Therefore, the gravity axis of the blade will be inclined to the pivoting axis of the flange so that the blade axis will swing along a conical arc, forward or rearward of the plane of hub rotation. When the blade axis falls within the plane of rotation, the blade pitch angle, thus oriented, is called *blade phase angle* (γ). The blade pitch angle will diminish when the blade axis swings forward of the plane of rotation, and the blade angle will increase when the blade axis swings to the rear of the plane of rotation, because the threaded hole into which the

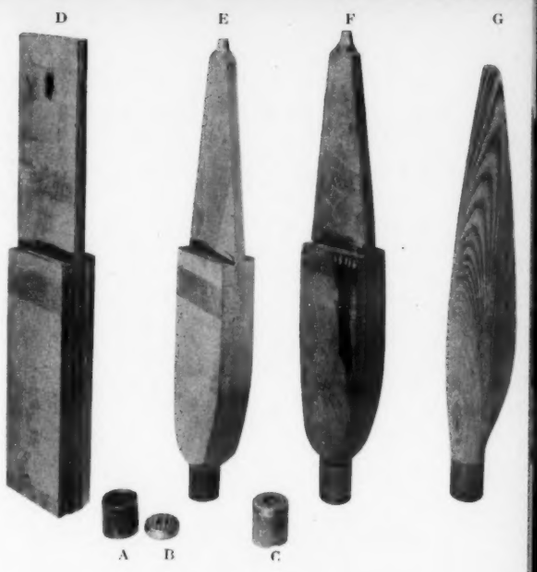
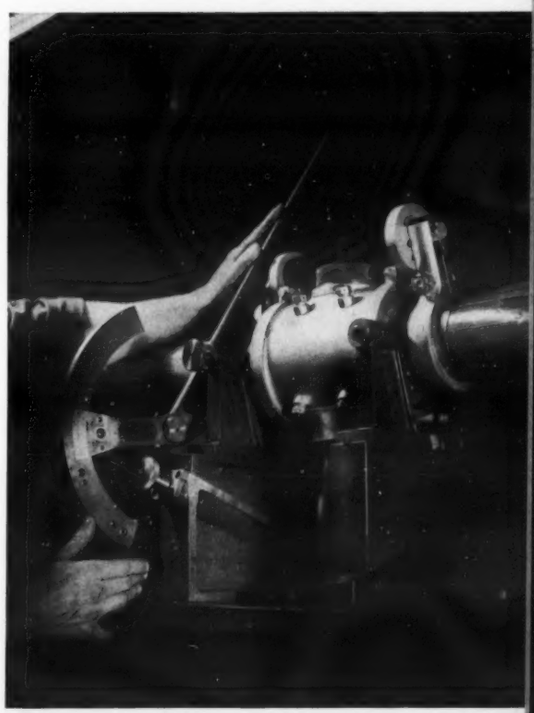


Fig. 6
Steps in the fabrication of a blade ferrule and blade. Parts " A " and " B " are copperbrazed and finish machined to produce the blade shank ferrule (" C "). The blade block (" D "), made from rotary-cut veneer laminations, is roughly cut out on a bandsaw, after which the shank end and centering cone are machined to the shape " E ". Blade block and blade ferrule are then assembled (" F ") ; " G " is the finished blade.

blade fits is so inclined to the pivoting axis of the flange that the gravity axis of the blade lags in respect to the propeller rotation (see Fig. 7).

One of the requirements fulfilled by the " Aeromatic " propeller is its ability to adjust itself automatically to all flight conditions and to maintain a virtually constant engine speed at a fixed throttle setting and altitude.

Fig. 11 : Checking the angularity of the counterweight arms of Aeromatic Model 220 propeller.



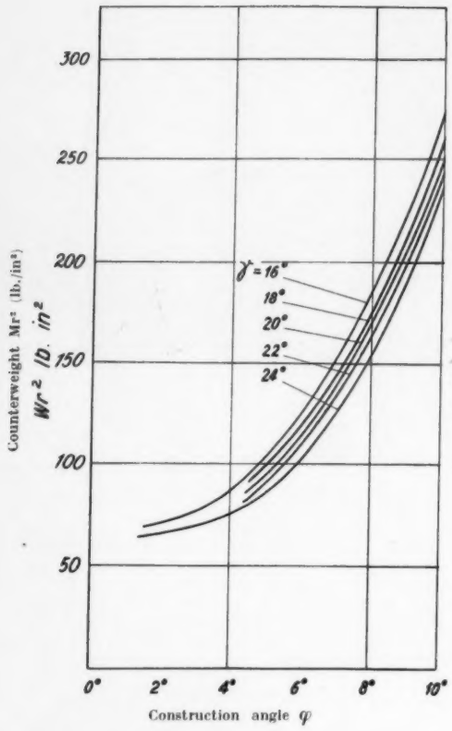


Fig. 8 :
Counterweight magnitude Wr^2 plotted against construction angle φ for different blade phase angles γ.

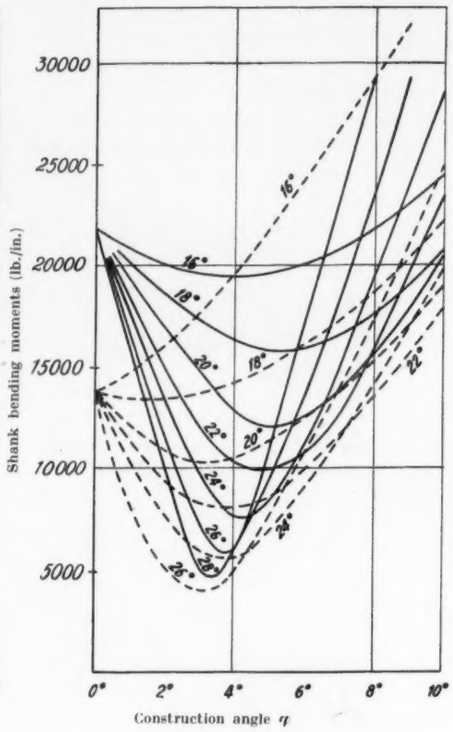


Fig. 9 :
Shank bending moments plotted against construction angle φ for different blade phase angles γ.

——— at 40 m.p.h. – – – – – at 140 m.p.h.

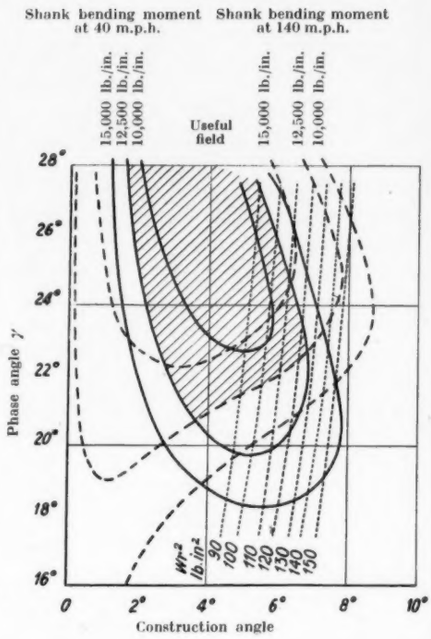


Fig. 10 :
Values of φ and γ at different shank bending moments and counterweight Mr^2.

The desired blade pitch change regulation curve is first established by calculating the variables which influence the operation. An abbreviated method of such procedure is outlined in the following paragraphs.

The numerical value of the aforementioned construction angle, blade phase angle, and blade mass are determined from the expression of the forces acting on the blade, which forces are considered to be in equilibrium for at least two flight conditions, e.g., static take-off and level flight. A typical analysis of range of these variables is graphically shown in Fig. 8, 9 and 10.

Preliminary calculations indicate, for instance, that for a certain installation the useful values of the *blade phase angle* γ should fall within the range of 16° to 24° and that the range of the *construction angle* φ would fall between 2° and 10°. The counterweight magnitude Wr^2 is then computed for several different values of γ and φ within this range. Graphically, the results of these computations for Wr^2 are shown in Fig. 8.

Fig. 9 is a graphical representation of the relations between the blade shank bending moments with respect to various values of construction angles and blade phase angles for two flight conditions. Analysing the range of values, a suitable construction angle is selected and incorporated in the detail design of the blade flange. This angle should result in values for the blade shank bending moment which are below the maximum allowable bending moment.

Fig. 10 is a composite graph comprising, *first*, the relation of counterweight magnitude with respect to various values of construction angle and phase angle, and *secondly*, the relation of the allowable blade shank bending moments with respect to various values of construction angles and blade phase angles. The curves of constant shank bending moment define a useful field of values of γ and φ. The corresponding counterweight magnitude Wr^2 may be read for any such pair.

All following data are now available to proceed with the assembly of the propeller for a specific application :

(1) construction angle which was built into the flange ;
(2) blade phase angle which determines the angular setting of the blade in relation to the blade flange ;
(3) angular setting of the counterweight arm and the amount of weight on end of arm ;
(4) setting of low and high pitch blade angle stops limiting the range of blade change between take-off RPM and placard diving speed.

The various parts of the propeller are assembled to these data. The settings are later checked or slightly modified during flight tests of the original installation. Thereafter all propellers for this same type of plane and engine combination are assembled identically with the original installation. Fig. 11 illustrates one of the adjustment steps, angularity of the counterweight arm being checked.

Finally, horizontal balance of the propeller assembly is achieved by selecting balancing weights for assembly into the hollow sockets of the balance weight bands on the outer end of the hub barrels. For vertical or 45° position, the band assemblies are shifted circumferentially until balance in all positions is established.

A modern twin-cell test and research building is equipped to test experimental settings and certain operating characteristics before flight tests.

Installation.

The installation of the "Aeromatic" propeller on the plane does not differ from the installation of a fixed-pitch propeller, whether it is a flange-type or spline-type of engine.

The majority of all installations fall in the 65 to 600 H.P. class, although high horsepower applications (over 2,000 H.P.) have been successfully tested. Five principal aircraft of the personal-use type are now factory equipped with three models of the "Aeromatic". These aircraft are : the Globe "Swift", Bellanca "Cruisair", Johnson "Rocket", North American "Navion" and the Republic "Seabee".

The Douglas AD-1 "Skyraider" with diving brakes deflected (plates on the underside and sides of the fuselage).

Douglas AD-1 "Skyraider"

Towards the end of the war, in June, 1944, the Douglas Aircraft Company undertook to develop a single-seater attack aeroplane, the Douglas AD-1 "Skyraider", for the U.S. Navy. A carrier-borne dive and torpedo-bomber, it incorporates many valuable data acquired from combat experience with this class of aeroplane. In designing the "Skyraider", an effort was made in the first place to keep the weight as low as possible; as a result the gross weight was fixed at only 16,120 lbs., in spite of the fact that, compared to its predecessors, the type was required to carry a greater useful load. It was through systematic studies that the original design weight could be reduced by 1,800 lbs.

The Douglas AD-1 "Skyraider" is an all-metal low-wing monoplane. Its trapezoidal wing, of 39 ft. 34 in. in span, features continuous spars. At points about half-way along the span, the two wing halves are fitted with hinges, enabling the outer panels to be folded upwards.

The sides and bottom of the semi-monocoque fuselage are virtually flat and taper rearwards to form a vertical wedge with the rudder unit. To ensure optimum vision, the cockpit, enclosed by a tear-drop canopy, is set fairly high and relatively far forward. The angle of vision forwards and downwards measures 15 deg. In order to economise weight the fuel is not carried in conventional wing tanks but in a single fuselage tank housed directly aft of the cockpit.

It was impossible, as a result, to stow bombs or torpedoes internally in a fuselage bomb bay. Torpedoes, bombs and rockets, totalling up to 6,000 lbs., are fitted under the wing and fuselage. The disadvantage of resultant higher drag, which somewhat reduces the radius of action and the speed of approach to the target, is again offset by the reduction in gross weight; moreover, this arrangement increases the type's versatility because it makes it possible to suspend supplementary drop tanks or radar equipment from the bomb racks.

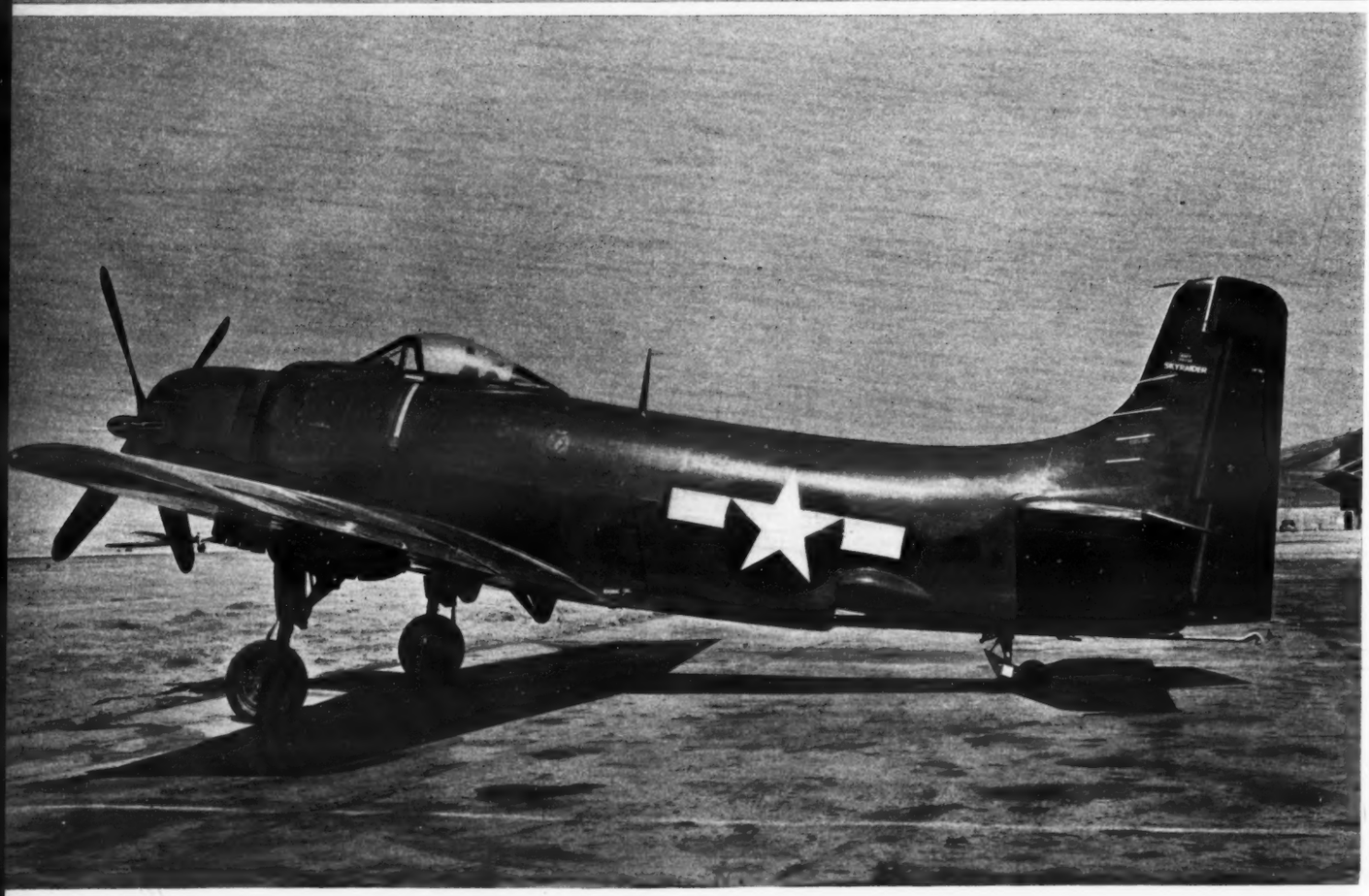
The installation of a conventional undercarriage in place of a tricycle type saved another 100 lbs. in structural weight. The main wheels retract into the underside of the wing, the wheels themselves turning through 90 deg.

A noteworthy feature of the Douglas AD-1 "Skyraider" is the arrangement of the diving brakes on the fuselage. The braking flaps consist of three flat plates which, in retracted position, lie flush with the fuselage sides and bottom, and are extended into braking position by means of hydraulic servo-motors. This somewhat unorthodox solution gave better results than diving brakes on the wings or parachute brakes in the tail, this because the lift distribution and stability are not affected by the deflection of the flaps.

In order to simplify the pilot's work as much as possible, special care was devoted to the arrangement of the cockpit. As it happens time and again that pilots commit errors in handling of the controls owing to fatique or carelessness, as a result of which an aeroplane can be damaged beyond repair, an attempt was made to eliminate these hazards by suitable shaping of the control levers and knobs. In collaboration with psychological research institutions, control levers and knobs were developed, the exterior shapes of which were designed to remind the pilot of their function. Thorough tests revealed that this aim is best achieved by making the shape of the control lever coincide as much as possible with the shape of the aircraft part to be operated, and by having the motion of the control correspond to the motion of the aircraft part in question.

Thus the levers operating the landing flaps, landing gear, arrester hook and diving brakes of the AD-1 were designed as minute replica

The entire war load of the "Skyraider" is carried on the wing underside.

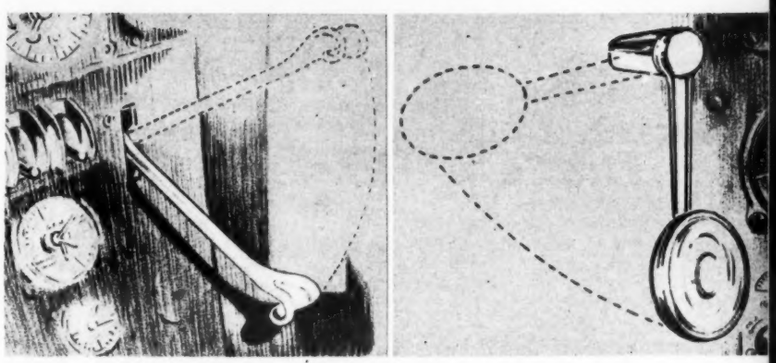


Arrangement of the diving brakes in the fuselage sides.

of these parts. The flap operating knob is shaped like an airfoil, horizontal in the normal position and moved upwards or downwards to lower or raise the flaps; similarly, the lever for the operation of the retractable arrester hook effectively bears a small hook, and the undercarriage is operated by a lever carrying a small wheel at its end. The diving brakes are deflected or retracted by a plate-shaped handle resembling one of the braking flaps.

These innovations, which will be incorporated in all production "Skyraiders", are expected to result in a considerable simplification of cockpit drill and a reduction in the number of accidents due to inadvertent operation of wrong controls. The new types of knob and lever are particularly appreciated on night operations, as the pilot will infallibly find the right control by mere groping for it.

The Douglas AD-1 "Skyraider" is one of the major aircraft types of the U.S. Navy of the immediate post-war years. The Douglas Aircraft Company's present contract amounts to approximately $ 50,000,000. *F. P.*



A section of the instrument panel showing the miniature replica of the arrester hook and the undercarriage lever bearing a small wheel at its end.

POWER PLANT:

Wright 3350-24W "Cyclone 18" 18-cylinder twin-row radial:
- Take-off power . . . . . 2,540 H.P.
- Rated power . . . . . 2,130 H.P. at 2,400 r.p.m.

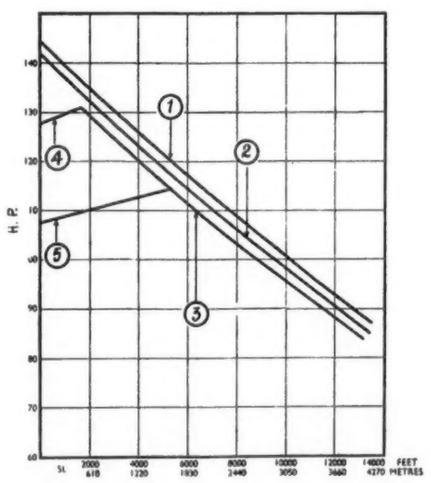
Aeroproducts H20 c. p. four-blade airscrew:
- Diameter . . . . . 15 ft. 6 in.

CHARACTERISTICS AND PERFORMANCE:

Span	50 ft. 6 ½ in.
Length	39 ft. 3 ¼ in.
Height	15 ft. 10 in.
Wing area	400.33 ft²
Aspect ratio	6.25
Gross weight	16,120 lbs.
Wing loading	40.3 lb./ft.²
Power loading	7.68 lb./H.P.
Max. speed	over 357 m. p. h.
Cruising speed	185 m. p. h.
Range	over 1,150 miles
Service ceiling	over 5,687 ft.

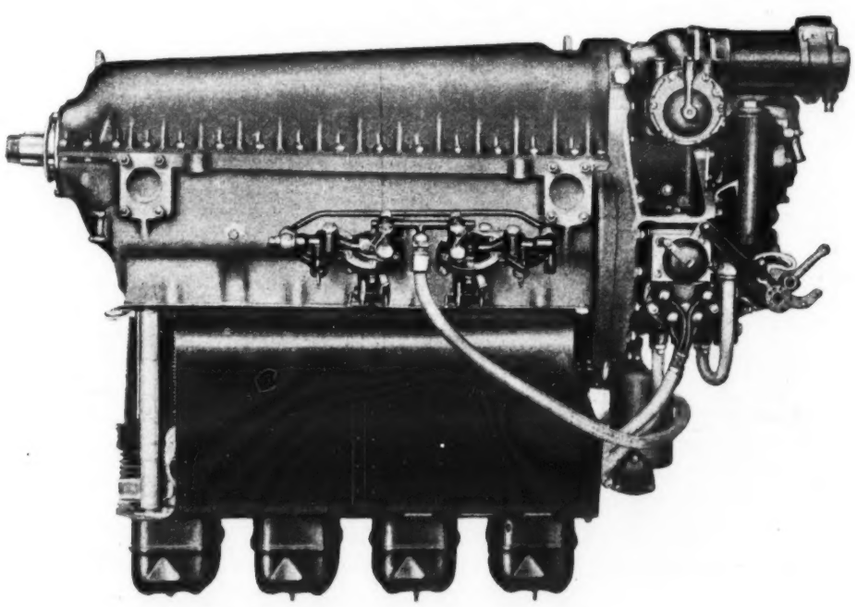
De Havilland "Gipsy Major 10"

Already well before the war, the "Gipsy Major I" aero engine had established a fine reputation for insurpassable reliability, longevity and economy. The de Havilland Engine Co., Ltd., of Edgware, Middlesex, are now producing a development of it, *the "Gipsy Major 10"* which presents no conspicuous external modifications but gives a power increase of about ten per cent without alteration of bore and stroke. By increasing the engine rotative speed from 2,100 r.p.m. to 2,300 r.p.m., and fitting a De Havilland manually-variable pitch propeller, the take-off output has been stepped up to 145 H. P. Another improvement incorporated in the "Gipsy Major 10" is the possibility provided for installation of a comprehensive range of accessories at the rear cover, such as starter, vacuum pump, and air compressor. After having been increased through two stages, the present overhaul period of the new four-cylinder unit is now 750 hours — half that of its predecessor. As it is basically the same engine, there is a likely possibility of the authorities' agreeing to a relaxation of these regulations very soon. When the "Gipsy Major I" was first introduced in 1932, the overhaul period was 450 hours, which was increased to 750 hours in the following year, and to 1,000 hours in 1937. After more than 7,800 units had left the factory during the war, this period grew through two stages to 1,260 hours, and finally to 1,500 hours in 1946.

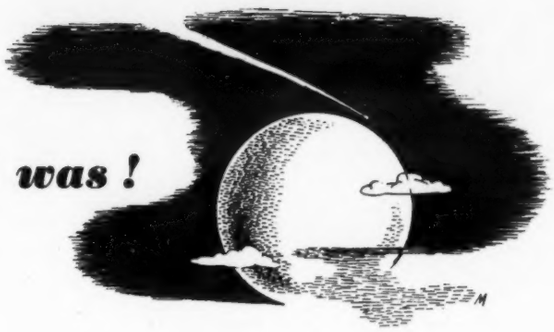


"GIPSY MAJOR 10" PERFORMANCE CURVES

1. Take-off and all-out level, 2,550 r. p. m.
2. Climb at 2,400 r. p. m.
3. Cruise at 2,300 r. p. m.
4. Rich mixture cruising.
5. Weak mixture cruising.



That's a Meteor - That was !



On the 15th of January, the famous Gloster "Meteor" world speed record jet aircraft zoomed over Paris at a speed which made your hair stand on end.

To tell the truth, my associations with jets had, until then, been confined to such innocent contraptions as gas stoves or garden hoses.

On January 15th, however, jets took on a new aspect. I was rudely awakened to the fact that they were not to be trifled with — and so was everyone else who got an earful of the "Meteor's" roar that day.

Whilst completing this speed monster, the designers boasted that it would make itself heard.

It may satisfy them to know that my eardrums are still throbbing from the experience.

Rushing home from school that particular afternoon, my little son was full of it. Scarcely pausing for breath, he told us about winged dragons spouting fire . . . and window panes smashed by the impact.

You see ? Jet planes indicate progress — an opinion likely to be shared by the glaziers !

It reminds me of my schooldays and a story in my English primer :

Mr. Brown of London meets M. Marius of Marseilles.

"Where I come from", said Mr. Brown, "the trains go so fast that one day I started lighting my pipe whilst leaving London and found myself in Dover before it had drawn."

"That's nothing", Marius retorted, "one day I got into a train at Marseilles, leaned out of the window to kiss my wife goodbye and suddenly found myself kissing the Avignon stationmaster."

I'm afraid that the same story centred around jets would tax even the legendary genius for exaggeration of Marius.

Indeed, had the good Marius boarded a jet, he would probably have found that the venerable stationmaster was still running around in short pants !

Grammar teachers are going to find themselves sorely harassed.

The speed of the "Meteor" and its contempories is indeed so great that you cannot say :

"It's going to fly past here."

Because it will already have flashed past by then.

If you want to say :

"Look ! It's overhead."

You'll find it about 10 miles away before the words are out of your mouth.

Maybe you *can* say :

"It flew past ; it was flying past ; or it has flown past . . ."

But, strange as it may seem, you'll have to agree : the aeroplane of to-morrow has no respect for tenses.

The layman's vocabulary, or for that matter even the aircraft designer's, scarcely suffices to describe the noise and speed of monsters like the "Meteor".

To call them high-speed aircraft is, to my mind, a gross understatement. And whereas a pyrotechnist might aptly refer to them as rockets, it now appears that rocket aircraft are actually another class yet to be heard, if not seen ! . . . What next ?

Yves GROSRICHARD.

Official Bulletin of the F.A.I.

FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE

The Meeting of the General Council of the FAI, Paris, January 21st-22nd, 1947.

The first meeting of the General Council of the FAI was opened by Lord Brabazon of Tara, President, at 10 o'clock on January 21st.

Present were : G. A. de Ro, Vice-President of the FAI, President of the Royal Aero Club of Belgium ; E. Falkmar, Secretary-General of the Royal Aero Club of Denmark ; Baron de La Grange, Vice-President of the FAI and President of the Aero Club of France ; Pierre Massenet, Vice-President of the Aero Club of France ; Whitney Willard Straight, President of the Royal Aero Club of Great Britain ; Colonel R. L. Preston, Secretary-General of the RAC ; Jonkheer van den Berch van Heemstede, Vice-President of the FAI ; Marcel Devaud, Vice-President of the FAI and President of the Aero Club of Switzerland ; F. Camerman, Secretary-General of the FAI ; Blondel de Rougery, Treasurer ; Jean Blériot ; Mme. Kleitz, Secretary to the FAI Bureau.

Group Captain C. Clarkson, delegate of the National Aeronautic Association of the U.S.A., was admitted to the General Council to represent the American point of view, but, not being an active member of the NAA, did not vote.

Each of the national Aero Clubs had a single vote. The delegate of the Royal Aero Club of Egypt, H. E. Abdulah Izzet Bey, arrived on January 22nd.

1. Liaison with PICAO.

The Secretary-General thanked Group Captain C. Clarkson for his work at the seat of PICAO during the last few months and for his report on PICAO's activities.

Group Captain Clarkson, in turn, submitted the results of his first contact with PICAO, where he was very well received. It was essential that the FAI should be represented at PICAO ; prestige and influence of the FAI would suffer if the Federation did not exercice a regular activity at the seat of the Organisation ; the FAI had, every interest in establishing a permanent section in the U.S.A. : firstly, to deal with private flying in the Western Hemisphere ; secondly, to maintain close liaison with PICAO. After due discussion of this suggestion, the usefulness of such a section was not denied. After a few differences of opinion concerning its precise duties and significance had been removed, Council members unanimously agreed to the following resolution :

„ The General Council give its Vice-President, W. R. Enyart, the powers necessary to establish, in the name of the FAI, an international branch organisation in the Western Hemisphere, to be known as the " Western Section of the FAI " (Section Occidentale de la Fédération aéronautique internationale). The following directives shall apply to this Section :

1. Its activity shall extend over the entire American Continent (North and South America) ; such activity shall be under the jurisdiction of the FAI and co-ordinated with the general policy of the Secretariat-General of the FAI.

2. The Section shall provide its own financial means and have no claim to any part of the membership fees payable by the national Aero Clubs of the Western Hemisphere. These contributions shall continue to be paid to the Treasurer of the FAI.

3. The Section shall be responsible for the creation and development of an International Bureau of Air Tourism for the Western Hemisphere ; whereas the Bureau's activity shall normally be confined to aerial tourism, it could be extended to any other task assigned to it by the FAI.

4. The Section shall represent the FAI at the seat of PICAO and take suitable measures to establish closest liaison with the various Divisions of this Organisation.

5. All regulations concerning records and their homologation shall remain the sole responsibility of the Secretariat-General of the FAI. "

The Section will probably comprise two Sub-Committees, one responsible for air tourism and one for liaison at the seat of PICAO.

The permanent representation of FAI at the seat of PICAO in Montreal will be assumed by General B. J. Kwiecinski, who will take up residence in Canada and is expected to leave Europe at the end of February. His appointment must be confirmed upon his arrival by W. R. Enyart, Vice-President of FAI and in charge of the Western Section.

2. The Situation of the National Aero Clubs. Applications for Re-admission by the Aero Clubs of Italy, Finland and Rumania. — Aero Club of Iceland.

The application for re-admission by the Aero Club of Italy was unanimously approved. For the first year the Club will have a single vote.

The General Council decided to postpone the re-admission of Finland and Rumania until after the signature of the respective Peace Treaties.

The Secretary-General read a communication from the Aero Club of Norway concerning the present situation of the Aero Club of Iceland. After an interruption of several years, the club is now being reorganised and will later establish contact with the FAI.

An application for admission by the Aero Club of Palestine was then discussed. The Royal Aero Club of Great Britain undertook to institute enquiries concerning this club and to submit its findings to the Secretariat-General.

3. FAI Gold Medal.

The names of two candidates were submitted : that of Igor Sikorsky, by the National Aeronautic Association of the U.S.A. ; and that of Group Captain Donaldson, by the Royal Aero Club of Great Britain.

After brief discussion by the General Council, Mr. Whitney Straight, the British delegate, withdrew Group Captain Donaldson's nomination and voted for NAA's application in favour of Igor Sikorsky, whose important work on the helicopter has greatly contributed to aviation.

In view of the courteous British withdrawal, the General Council decided unanimously to confer the medal on Igor Sikorsky, with congratulations. Simultaneously it renewed its thanks to G. L. Cabot, donor of the Gold Medal for 1946.

4. De La Vaulx Medals.

Secretary-General Camerman reported that so far he had not been able to procure sufficient silver for the coining of more than one medal ; he was hoping shortly to obtain enough metal for the four medals awarded in 1944 and 1946. These medals were conferred upon the following four new world record holders :

Group Captain H. Wilson — Speed over a 3-km course : 975.675 km/h ; 7th November, 1945.
Col. C. S. Irvine — Distance in a straight line : 12,739.591 km ; in November, 1945.
Group Captain E. M. Donaldson — Speed over a 3-km course : 991 km/h ; 7th September, 1946.
Commander T. D. Davies — Distance in a straight line : 18,081.880 km ; 1st October, 1946.

Igor Ivan Sikorsky was awarded the FAI Gold Medal in recognition of his work in the development of the helicopter.

Group Captain Edward M. Donaldson, holder of the World Speed Record of 991 km/h, received the Silver Medal of Count de la Vaulx.

5. Louis Blériot Cup.

According to the Secretary-General, the Cup is in the safekeeping of the Aero Club of Italy, which will pay for the replacement of certain silver ornamentations that have disappeared. The Aero Club of France has extended the competition by another five years, to December 31st, 1951.

6. Princess Bibesco Cup.

As several formulae are envisaged for the award of this prize, both as regards the purse to be given and the possibilities of organisation, this question was referred to the Sporting Commission ; the Commission will report on the type of competition to be organised as well as on the amount of the purse.

7. Modifications to the rules governing speed, distance and altitude records.

The three-man Special Committee has submitted its report to the representative of the Aero Club of France, who has given it his approval. The Secretary-General will circulate the recommendations of the Committee, so that the General Conference of September, 1947, will be able to make its decisions.

8. Revision of the Sporting Code Model Flying Regulations.

The five-man Committee voted at the London Conference is to be convened by Major Mayo as soon as sufficient progress has been made in the elaboration of the new record regulations. Four of the five members have already been nominated : Squadron Leader E. H. D. Spence (Great Britain), Albert Maréchal (Belgium), N. V. Sluyter (Holland) and Louis Couhé (France) ; the American NAA will name its representative shortly.

The various Aero Clubs, particularly the British Royal Aero Club which has studied the question in detail, were requested to submit their criticisms of the Sporting Flying Regulations as well as any suggested alterations, to the Secretary-General. Baron de la Grange undertook to see to it that a preliminary study of the question be made by the Aero Club of France ; Vice-President Pierre Massenet of the Aero Club of France will work out a draft of the new regulations.

The General Council unanimously approved the model flying regulations incorporating the modifications decided upon in London by the Model Flying Commission ; they will enter into force on April 1st, 1947.

9. Helicopter Records.

In agreement with the decisions of the Conference of September, 1946, the General Council confirmed that identical records will be recognised in Classes C and G. The special records in Class G, listed on page 102 of the annexe to the Sporting Code, were abolished ; Class G is to be added on page 89 to Classes C, C-bis, C-ter and E.

10. Vertical Checking of an Aircraft's Passage.

The Secretariat-General has so far received no reply to this question ; however, the Delegate of the Aero Club of Great Britain announced the results of a detailed study carried out at his request in England. It was found that the problem is difficult to solve. The Council, therefore, decided at the suggestion of the British delegate that each country applying for recognition of a record, should submit details of its measuring method for approval by the FAI.

11. Balloon Commission Appointments.

As members were nominated : Lord Ventry (Great Britain), Ernest Demuyter (Belgium), U. Boesman (Holland), Charles Dollfus (France), Rear-Admiral C. E. Rosendahl (U.S.A.), Lieutenant-Colonel Ernst Huber (Switzerland). The President recommended that the Commission convene as soon as possible.

12. Commissions for Aerology and Air Medicine.

The British delegate opined that it was not indispensable to retain both Commissions. In his view, medical questions should be treated by each individual Aero Club in consultation with its Government. In addition, every Commission was a source of expenditure, both for the FAI and its members. The Dutch delegate concurred with this point of view. The Council decided to retain both Commissions, but to convene them only in emergencies and then only for brief periods ; the present members retain their appointments but no new ones will be elected.

13. Air Touring Commission.

a) Air Tourist Identity Card. — The British delegate described the results obtained from the competent British Authorities by the Royal Aero Club : against payment of £ 5.0.0, of which £ 4.10.0. is collected by the Government and 10/- by the Aero Club, a private pilot can obtain an identity card allowing him to utilise any public aerodrome in Great Britain.

A similar arrangement was reached with the Aerodrome Owners Association, as a result of which the holder of an Identity Card, after paying £ 10.0.0, is entitled to land on any civil aerodrome in the United Kingdom. The British Government decided to grant this advantage on the basis of reciprocity also to foreign private pilots and in this case to remit £ 1.0.0. of the fees collected for each card to the FAI. (The British Government is expected to ratify this combined solution in the near future.) Monsieur de Ro stated that a similar agreement had recently been reached with the Belgian Government.

The General Council of the FAI requested that all member clubs expedite negotiations with their Governments, and report the results to the Secretariat-General ; these will immediately be communicated to the clubs.

b) Customs Carnets. — A model of the new carnet will shortly be distributed to clubs ; these are expected to hand in their observations in the near future, which will enable the General Conference of next September to take final action on the matter.

14. Gliding Commission.

a) Succession to ISTUS. — The decisions of the Gliding Commission of November 25th, 1946, were confirmed, and the Secretary-General was requested to establish, as soon as possible, contact with the UNESCO in order to determine to what extent this organisation can assume the duty of publishing and circulating research reports and technical studies.

b) International Gliding Competition, 1948. — The Royal Aero Club requested a delay of three months to enable it to study whether the event can be organised in Great Britain. On behalf of the Swiss Aero Club Monsieur Devaud declared that Switzerland was prepared to organise the competition should Britain not be able to do so. Great Britain will, therefore, communicate its decision to the Secretariat-General within three months, upon which FAI will inform the Aero Club of Switzerland accordingly.

Remaining decisions of the Gliding Commission concerning competition and record regulations, and the award of the gold and silver insignia, were ratified and will enter into force on April 1st, 1947.

The matter of the Bureau of Air Tourism (item 15 on the Agenda) was treated jointly with the budget estimate.

16. Calendar of 1947 Events.

For entries in the Official FAI Calendar of International Aviation Events, the following fees are charged :

1. Category with exclusivity of the stipulated date : Fr. frs. 10,000.—
2. Category without exclusivity Fr. frs. 1,000.—

Model flying events will always be considered as belonging to the second category. Rallies are not considered as performance tests or competitions, in the view of the Council, and are, therefore, not required to pay fees for entry in the Calendar.

So far only two events figure in the Calendar for 1947.

June 22nd : International model competition in Zurich.

July 5th-6th : International air meeting in Brussels, on the occasion of the Third Aero Show.

A third event was entered after conclusion of the General Council meeting :

July 30th to Aug. 9th : " International Soaring Week in the Engadine ", team competition for single and two-seaters at Samaden, Switzerland.

The Secretary-General communicates the dates of other events scheduled for 1947 :

March 30th : Rally to Nimes, France.

July 4th-20th : Third International Aero Show in Brussels.

July 5th-7th : Rally to Le Touquet, France.

August 2nd-3rd : Rally to St. Cyr, organised by the Aero Club of Versailles.

October-November : Rally to the Belgian Congo Colony.

17. FAI Insignia.

Concerning the new design suggested by the Aero Club of France, the Council decided to postpone the matter until September and requested the various Aero Clubs to submit their suggestions prior to the General Meeting.

15. and 18. Budget Estimate for 1947. — Auditing of accounts — Fees for the homologation of world and international records — Bureau of Air Tourism.

The Treasurer announced his 1947 budget estimate, as follows :

Revenue.

Membership Fees : 40 Votes at Fr. frs. 10,000	400,000
Customs Carnets	375,000
Record Homologations	300,000
	1,075,000

Expenditure.

Secretariat (4 Employees and Translators)	586,000
Social Charges	57,000
Office Rent	30,000
Publication of 3 Bulletins	250,000
Information Circulars	18,000
Conferences and General Council	110,000
Checking of Records	25,000
Printing of Customs Carnets	65,000
Upkeep of Premises	24,000
Sundries : Postage, Telephone, incidentals	120,000
	1,310,000
Estimated Deficit	235,000
Cash in Hand on December 31st, 1946	431,770
Cash in Hand on December 31st, 1947, would therefore be reduced to	196,770

Colonel Preston expressed the desire that future budget estimates be transmitted to delegates ahead of the meeting to enable them to prepare their observations and recommendations for the Conference of the General Council. The Council also requested the Treasurer to submit if possible a tentative budget estimate to the General Meeting of September, 1947, for 1948. The 1947 Budget estimate was then approved.

The British delegate would welcome a considerable broadening of the rôle played by FAI. In his view, the Secretariat-General should be enabled to enlarge its activities. It would be desirable, in particular, to supply all Aero Clubs with a brief, weekly information

Bulletin containing notices in English and French, which could be of use to international flying.

The Treasurer estimated that such an information bulletin would require an additional expenditure of about Fr. frs. 400,000 and asked the Council to suggest a method whereby the supplementary funds could be raised.

Two solutions were suggested :

a) The information bulletin could be supplied on a subscription basis, each Club acquiring a certain number of copies ; private persons could also subscribe.

b) Some of those present suggested that the bulletin be distributed free and that its cost be covered from other sources. Funds could be obtained by increased annual membership fees, from contributions from a special fund formed by voluntary donations from Member Clubs and business circles, from advertising revenue, etc.

Mr. Devaud pointed to the agreements between the Central Council of International Tourism (Conseil central de tourisme international) and the International Association of Automobile Clubs ; under these arrangements an organisation for the diffusion of all news suitable for the encouragement of tourist traffic is to be created. The FAI should be given a place in this organisation, and the latter could publish the news bulletin for air tourists in accordance with Colonel Preston's wish.

Baron de La Grange expressed his willingness to enter into contact with the Count of Rohan, President of the Automobile Club of France, for the purpose of obtaining precise information.

Finally, the General Council appointed a sub-Committee consisting of Messrs. de Ro and Devaud, and two members representing the Aero Club of France and the British Royal Aero Club ; the sub-Committee is to study the budget of the FAI and particularly the question of publication and financing of the suggested weekly information bulletin. The Secretary-General will supply all the necessary information and documentation.

1947 FAI Conference in Geneva.

The date of the Annual General Meeting of the FAI was fixed for September 17th-19th.

RECORDS HOMOLOGATED BY THE FAI

CLASS C

Speed over 1,000 km (U.S.A.).

Lt. Henry A. Johnson, USAAF.

Lockheed P-80 monoplane, GE-I-40 gas turbine engine.

Dayton, Ohio, 3rd June, 1946. 745.079 km/h

Payload 1,000 kg, Speed over 1,000 km (U.S.A.).

Lt.-Col. T. P. Geretty, Pilot ; Capt. W. K. Rickert, Co-pilot.

Douglas XA-26F monoplane, two 2,000-H.P. Wright R-2800-83's and one GE-I-16 gas turbine engine.

Dayton, Ohio, 20th June, 1946. 660.526 km/h

Payload 2,000 kg, Speed over 5,000 km (U.S.A.).

Capt. James E. Bauer, Pilot ; Capt. J. F. Cotton, Co-pilot.

Boeing B-29 monoplane, four 2,200-H.P. Wright R-3350-23A's.

Dayton, Ohio, 28th June, 1946. 544.590 km/h

Under Article 92 of the Sporting Regulations, *Pilots Bauer and Cotton simultaneously become holders of the following records :*

Payload, 1,000 kg, Speed over 5,000 km (U.S.A.). 544.590 km/h

Without payloads, speed over 5,000 km. 544.590 km/h

Payload 10,000 kg.

Capt. J. D. Bartlett, Pilot ; Lt. William Murray, Co-Pilot.

Boeing B-29 monoplane, four 2,200-H.P. Wright R-3350-23A's.

Dayton, Ohio, 19th May, 1946.

Speed over 1,000 km (U.S.A.). 575.714 km/h

Speed over 2,000 km (U.S.A.). 574.593 km/h

CLASS G — Helicopters.

Speed over 20 km in closed circuit (U.S.A.).

Lt.-Col. K. S. Wilson, USAAF.

Sikorsky R-5A helicopter, 450-H.P. Pratt & Whitney R-985-AN-5.

Dayton, Ohio, 3rd June, 1946. 178.394 km/h

Speed over 1,000 km (U.S.A.).

Major D. H. Jensen, USAAF, Pilot ; Major W. C. Dodds, Co-Pilot.

Sikorsky R-5A helicopter, 450-H.P. Pratt & Whitney R-985.

Dayton, Ohio, 14th November, 1946. 107.251 km/h

Consolidated XB-46

At the end of January, 1947, the *Consolidated Vultee Aircraft Corp.*, San Diego, California, released first details concerning its new four-jet medium bomber. The type, designated *XB-46*, is characterised by its pointed nose and slender fuselage, a pure solid of rotation. Another remarkable feature is its extremely slender wing, probably a development of the Davis wing which Consolidated have been using for years. Designed as a high-performance aircraft with a speed which will presumably approach that of sound, the XB-46 possesses no protuberances from the fuselage, with the exception of the cockpit enclosure. As a result, the crew stations do not seem to be as spacious as in earlier types, nor do vision conditions seem to be as good. Four General Electric gas turbines are mounted in pairs in two oval nacelles under the wing. Performance details of this latest Convair aeroplane, the span of which is 113 ft. and the length 105 ft. 9 in., have not yet been released.

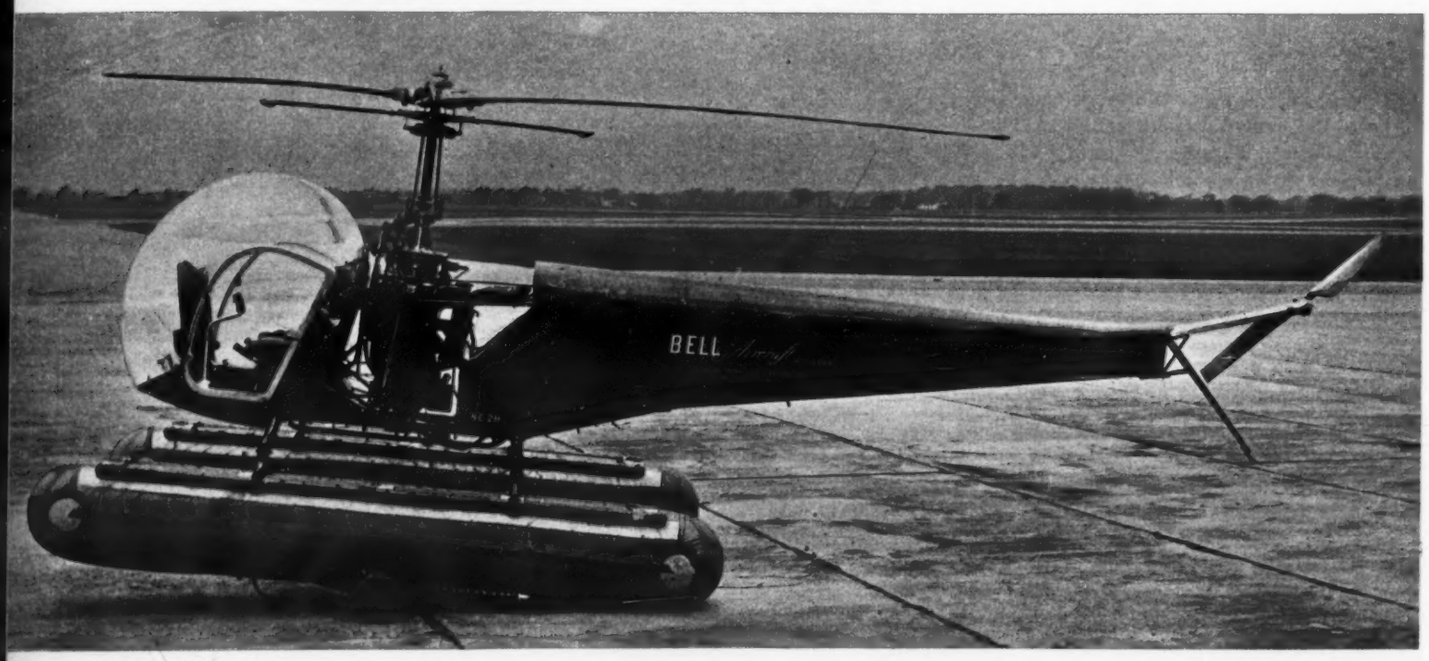
Bell Model 47, two-seater helicopter of the U.S. Army Air Forces.

HELICOPTERS

The Bell Aircraft Corp., of Niagara Falls, N. Y., which won particular prominence at the beginning of World War II with its P-39 "Airacobra" single-seater fighter, has concentrated its efforts since the end of the war chiefly on the design and development of jet aircraft and hit the headlines particularly by building the XS-1 experimental supersonic aeroplane. But Bell simultaneously paid a great amount of attention to other projects and in recent months has brought out two helicopter types suitable for civilian or military use.

As long ago as in March, 1946, the Bell Aircraft Corp. was granted a type certificate by the Civil Aeronautics Administration for the *Bell Model 47* two-seater helicopter. The two-blade rotor features the Bell stabilizer bar for the control of the blade pitch, whilst torque is compensated by an auxiliary rotor mounted at the tail of the aircraft. Fitted with two

Bell Model 47 fitted with rubber floats, ordered for geological surveys in Northern Canada.



Bell Model 47-B two-seater air mail helicopter.

pairs of wheels, the type is being built under the military designation of *YR-13* both for the Army and the Navy. The two seats, arranged side-by-side, are completely enclosed in a large, round bubble canopy, allowing free vision in all directions. The civilian *Bell Model 47-B,* which has a more conventional cabin with side windows, has been ordered in considerable numbers by air mail contractors, firms specializing in crop dusting, etc. Power plant is a 140-H.P. Franklin air-cooled flat-six, cooled by a fan situated in the bottom of the fuselage.

The *Bell Model 47* two-seater has the following characteristics : Rotor diameter, 33 ft. ; rotor blade chord, at root, 12 in., at the tip, 9 in. ; rotor disc area, 855 sq. ft. ; anti-torque rotor diameter, 5 ft. ; gross weight with one occupant, 1,550 lbs. ; maximum gross weight, 1,750 lbs. ; power required for level flight at 50 m.p.h., 60 H.P. ; for hovering, 110 H.P. ; estimated top speed, more than 100 m.p.h. ; cruising speed, 80-90 m.p.h.

Bell Model 42, five-seater small feeder-line helicopter, powered with a 600-H.P. Pratt & Whitney "Wasp" radial.

The second Bell helicopter on the market today, the *Model 42,* is intended as a small feeder transport and accommodates five persons. In general design it roughly resembles the two-seater, except that it has a nose-wheel landing gear and a three-blade tail rotor. The power plant consists of a 600-H.P. Pratt & Whitney "Wasp" radial engine. The rotor hub is driven at a reduction gear ratio of 9 to 1 via a centrifugal coupling engaging at 1,200 r.p.m., which enables the machine to descend by means of auto-rotation.

The five-seater *Bell 42* has an empty weight, fully equipped, of 3,446 lbs., carries a useful load of 1,455 lbs. and has a gross weight of 4,891 lbs. Its maximum speed is given as 125 m.p.h., its cruising speed as 110 m.p.h., and its range as approximately 300 miles.

Bi.

Swissair Reorganisation

When the inaugural number of this new publication by our firm appeared at the end of April, 1946, the *Swiss Minister of Transport, Dr. Enrico Celio,* wrote in the introduction : "*Discussions are under way for the creation of a Swiss national air transport company to operate domestic, international and inter-continental routes.*" — This was the theme of the *reorganisation programme of Swiss air transport* which has been worked on since early 1946 and can be counted as *accomplished since February, 1947.*

At this date an *Extraordinary General Meeting of Swissair A. G.* took place, during the course of which 3 decisive conclusions were reached concerning the future of Swiss air transport activities.

1. The increase of Swissair capital from Fr. 1,000,000 to Fr. 20,000,000 was confirmed, and the total shareholding capital was paid up. This is composed of 40,000 registered shares of Fr. 500 nominal value, holders of which must be Swiss citizens, corporations, institutions or firms.

2. Swissair has been converted into a mixed financial undertaking, whose capital is held partly by private and partly by public resources ; some 60 % of the shares are possessed by private individuals or concerns and some 40 % are in the hands of the Federal Government and of the Cantonal and City authorities.

3. The old Board of Directors resigned and a new Board was appointed ; the number of Members is limited to 27. Of these, 26 have already been nominated, 16 representing private enterprise and 10 the State.

Dr. RUDOLF SPEICH,
Chairman of the Board of Directors.

At the same time the General Meeting was informed by the Federal Delegate for Civil Aviation, Prof. Ed. Amstutz, that the second Swiss Air transport concern, Alpar A. G., Berne, had just *decided in favour of a merger with Swissair.* This effectively fulfilled the programme drawn up by Dr. Celio at the beginning of 1946 : Switzerland now possesses a single national airline, Swissair. To achieve this, it required tedious discussions and prolonged efforts by the Federal Council, the Delegate for Civil Aviation, the Chief of the Federal Air Department, the two undertakings concerned as well as various economic circles in Switzerland.

Swissair is a carrier which, though it operates only Continental routes for the present, all the same possesses an international reputation. Moreover, its new capital basis definitely makes it an interesting customer for foreign aircraft industries, and it achieves a further degree of importance in view of its numerous pool operations. Hence a list of the names of the new Members of the Board of Directors is not without interest.

Chairman : Dr. Rud. Speich, President of the Swiss Bank Union.

Vice-Chairman : Prof. Ed. Amstutz, Delegate of the Federal Government.

Vice-Chairman : Colonel Edgar Primault, President of the Swiss Watch Chamber.

Members : Guillaume Bordier, Geneva Banker ; *Dr. Alphonse Ehinger,* Basle Banker, former Chairman of the Board of Directors ; *Georg Fischer,* Director, Maag-Maschinen A. G., Zurich ; *Dr. Rudolf Heberlein,* Industrialist, Wattwil ; *Dr. h. c. Hans Hunziker,* Director of the Central Office for International Railway Traffic ; *Paul Joerin,* Member of the Basle Chamber of Commerce ; *Adrien Lachenal,* National Councillor, Geneva ; *Dr. Albert Linder,* Managing-Director of the Swiss Credit Bank ; *Alfred Oehler,* Aarau Industrialist ; *Peter Reinhart,* Volkart Bros., Winterthur ; *Colonel Ernst Schmidheiny,* Geneva Industrialist ; *Colonel Edwin Schwarzenbach,* Zurich Industrialist ; *Dr. A. Wilhelm,* Managing-Director of CIBA, Basle ; *Dr. Charles Zoelly,* Managing-Director of the Swiss Bank Society ; *Dr. George Hasler,* Managing-Director of the Winterthur Accident Insurance Company ; *Dr. Eberhard Reinhardt,* Chief of the Federal Finance Administration ; *Dr. Fritz Hess,* Managing-Director of the Post Office Administration ; *Dr. Maurice Paschoud,* Managing-Director of the Swiss Federal Railways ; National Councillors *Casai* (Canton of Geneva), *Dr. Streuli* (Canton of Zurich), *Dr. Wenk* (Canton of Basle), *Brenno Galli* (Canton of Tessin) and *Dr. Lüchinger,* Mayor of Zurich.

A 27th Member of the Board of Directors is to be provided by the Canton of Berne after consummation of the merger with Alpar. The *Committee of the Board of Directors* comprises the Chairman and the two Vice-Chairmen, together with Dr. Ehinger, Dr. Hunziker, George Fischer and Dr. Streuli.

This list effectively includes all leading men in Swiss private enterprise and public organisation.

The *Management of Swissair* comprises : Eugen Groh, who has been Commercial Manager for many years ; Dr. Gottfried von Meiss, who was appointed Technical Manager in 1946 ; and Ulrich Keller, Assistant Manager.

Already this year the Management will move into a *new head office* in *Zurich,* and a *branch management office* will be established *in Geneva.* At the time of writing, the carrier's fleet consists of four Douglas DC-4's, delivered or in the process of delivery, ten Douglas DC-3's and three smaller aircraft for special trips. The merger with Alpar will slightly increase this total.

A new *re-equipment* programme is in the course of preparation and the cash resources of the company are such that no difficulty is likely to occur in its achievement. *Aircrew personnel* at present comprises 19 pilots and 14 radio operators, besides 16 pilots and 12 radio operators under training.

The re-organisation will be followed by expansion ; and Swissair gives the first indication of this with an announcement that a *Swiss North Atlantic service* will be started on May 2nd, 1947. *E.E.H.*

Prof. ED. AMSTUTZ,
Vice-Chairman of the Board of Directors.

Colonel ED. PRIMAULT,
Vice-Chairman of the Board of Directors.

EUGEN GROH,
Commercial Manager.

Dr. G. von MEISS,
Technical Manager.

THE MONTH IN REVIEW

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POLITICAL

● According to reports from Washington, Great Britain and the USA are negotiating for the release of *Kindley Field*, the only landplane base in Bermuda, to *international commercial aviation*. Leased on a 99-year basis by the USA, the airfield was developed as a USAAF bomber base.

● The new Italian *de Gasperi Cabinet* has grouped the former Ministries for War, Navy and Air into a *Defence Ministry* under *Luigi Gasparotto*, War Minister in 1921 and Air Minister in Bonomi's second Cabinet in 1945. *Giuseppe Brusasca* is *Under-Secretary of State for Air*.

● The Swedish Air Board, which recently became a separate Government Department, has had its requested vote of Kr. 37,200,000 for the *expansion of airports* cut down to Kr. 18,100,000 in the Swedish Budget for 1947/48.

● *Bilateral Civil Aviation Agreements* have been concluded between the following countries: Ireland-Czechoslovakia (January 29th), The Lebanon-Saudi Arabia (January 15th), USA-Peru (December 27th, 1946); a temporary agreement was reached between Great Britain and Peru. Negotiations for other agreements are in progress between Australia and the Philippine Republic, Holland and India, Iraq and Iran, Sweden and Portugal, and the USSR and France. Negotiations between Denmark and the USSR resulted in an impasse.

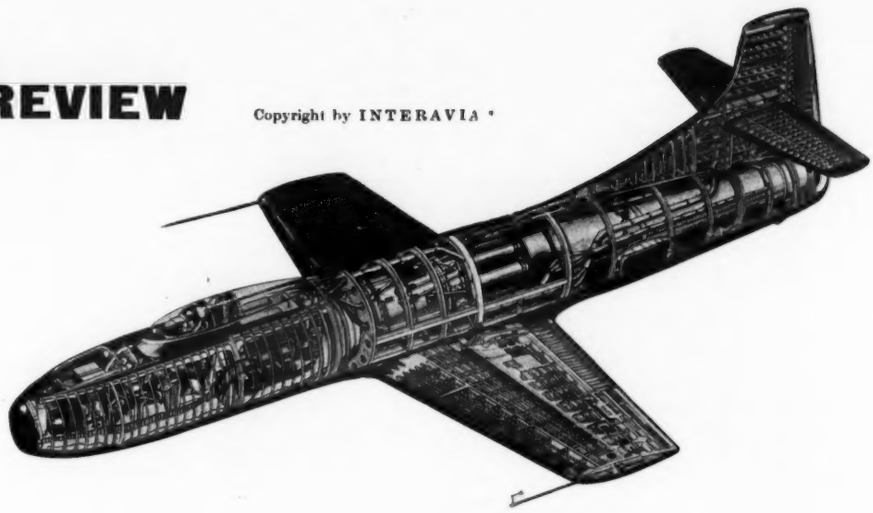
● The Argentine-Swiss commercial pact, concluded on January 20th, foresees negotiations for a bilateral *Civil Aviation Agreement* on the basis of full reciprocity of transit and landing rights.

NEW AIRCRAFT

● The prototype *Consolidated-Vultee XC-99* six-engined commercial transport, developed by Consolidated-Vultee Aircraft Corp. for the USAAF, is nearing completion. Transport counterpart of the Consolidated-Vultee B-36 bomber, its fuselage is identical to that of the Consolidated-Vultee 37 airliner project. Its two decks provide room for 400 troops, 335 stretcher cases or 100,000 lbs. of cargo. Driven by 6 Pratt & Whitney "Wasp Major" air-cooled 28-cylinder 4-row radials developing 3,000 HP, its range exceeds 8,000 miles.

● Lockheed Aircraft Corp. is at present studying the possibility of applying *electric pre-rotation to the main landing wheels of the Lockheed XR-60 "Constitution"*; wheel surface velocity should correspond to the landing speed.

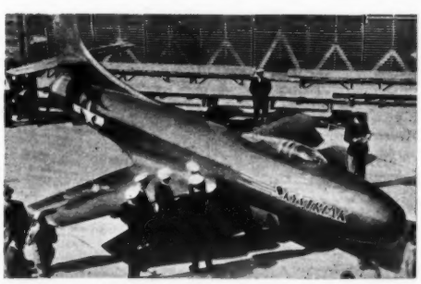
● Ryan Aeronautical Co. are developing a new carrier-based single-seater experimental fighter, the *Ryan XF2R-1*, for the US Navy; to all appearances a development of the Ryan FR-1 "Fireball" carrier fighter, the XF2R-1 is powered with a General Electric TG-100 gas turbine driving a four-blade c. p. airscrew, and a General Electric I-16 turbo-jet in the tail.



Douglas D-558 "Skystreak".

Ryan XF2R-1.

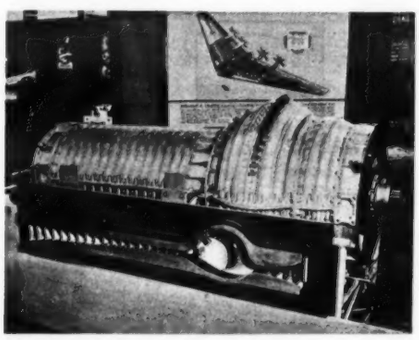
● The *Douglas D-558 "Skystreak"*, a new experimental supersonic aircraft being developed for the US Navy by Douglas Aircraft Co., is, contrary to previous reports, not powered with a rocket engine, but with a conventional General Electric TG-180 turbo-jet unit in the centre fuselage. Its wing loading works out at 65 lb./sq. ft.



Douglas D-558 "Skystreak"

● During a test on January 18th of the *Bell XS-1* supersonic aircraft, one third of the available power of its rocket engines was applied; it reportedly attained up to 500 m. p. h. at an altitude of about 30,000 ft.

● Northrop Hendy Co., a subsidiary of Northrop Aircraft Inc., has developed a gas turbine-propeller engine of 2,400 HP, designated *Northrop Hendy "Turbodyne I"*.



Northrop Hendy "Turbodyne I".

● The French national SNCA du Sud-Est aircraft concern is developing an experimental all-wing jet-propelled aircraft with a gross weight of 14.8 tons, the *SE 1800*, which it is hoped will supply data for a corresponding high-speed transport of 197 tons gross weight.

Consolidated-Vultee XC-99.

* Abridged extracts from Nos. 1258-1270 (January 18th to February 15th) of "INTERAVIA, International Correspondence on Aviation", an illustrated newsletter published three times weekly in four separate language editions, English, French, Spanish and German.

INDUSTRY

● *Consolidated-Vultee Aircraft Corp. and Lockheed Aircraft Corp.* issued a joint statement on February 5th, stating that the negotiations for a *merger* of the two companies have definitely been *abandoned*.

● The US Civil Aeronautics Board has instituted a new class of licence for surplus military aircraft available for sale to the public. These aircraft must carry the registration letters "NL" and may not be used to carry passengers or freight for remunerative purposes.

● *Westland Aircraft Ltd.*, Yeovil, Somerset, has acquired a licence to construct *Sikorsky S-51* helicopters.

● On January 20th North American Aviation Inc. raised the sales price of their *North American "Navion"* four-seater tourer from $ 6,100 to $ 7,750.

● From January 27th to 30th, 1947, the *Institute of the Aeronautical Sciences* (I. Ae. S.) held its 15th Annual Meeting in New York. The three main lectures were given: Major-General Curtis E. LeMay ("The Air Forces Development Programme"), Rear-Admiral L. C. Stevens ("Problems of Naval Aviation which confront the Aeronautical Engineer"), and William A. M. Burden, Assistant Secretary of the US Commerce Department ("The Engineers' Part in Civil Aviation Expansion"). *Preston R. Bassett*, President of the Sperry Gyroscope Corp., was elected *President* for 1947; *Sir Geoffrey de Havilland* was made an *Honorary Fellow*.

● Sixteen technicians, from Belgium, China, France, Holland, Italy, Sweden, Switzerland and the USA, started a two-week course of instruction at the British Government-owned *National Gas Turbine Establishment* at Lutterworth, Leicestershire, on February 3rd.

● *Avions Marcel Bloch*, the French aircraft firm, has changed its registered address from 1, rue de la Pompe, to 46, avenue Kléber, Paris (Telephone: Kléber 23-37). Its founder has changed his name and that of the firm to *Marcel Dassault*.

INDUSTRIAL PERSONALITIES

● *Lieutenant-General Oliver P. Echols* has been appointed *President of the Aircraft Industries Association of America*; previous to this he was chief of the USAAF Civil Affairs Division.

● *A. W. Martyn*, founder of Gloster Aircraft Co., has died in London at the age of 76. In 1927 he retired from the Gloster Aircraft Co. and in 1935 joined the Board of Directors of Dowty Equipment Ltd., the accessory manufacturers, becoming Chairman in 1936 and remaining in that position until his death.

● *Air Associates Inc.*, the American accessory manufacturers, have appointed *Lieutenant-General Barney McKinney Giles*, who commanded US Army Forces units in the Pacific, as their *Technical Manager*.

INTERNATIONAL ORGANISATIONS

● *PICAO* and *ICAO*: The Seventh Session of the Interim Council of the *Provisional International Civil Aviation Organisation* opened on January 7th. It was decided that *Montreal* should be the seat of the first meeting of the *International Civil Aviation Organisation* (ICAO) on May 6th, 1947. The principal item on the agenda in May will be the question of a *Multilateral Air Pact*, as sought by the USA and Great Britain. — The Annual Meeting of the *Maps and Charts Division (MAP)* of the PICAO Flight Safety Committee started on January 14th with 16 States in attendance. — On February 4th, delegates of 17 nations were present in Melbourne at the opening of the *South Pacific Air Navigation Conference of PICAO* under the Chairmanship of Air Marshal R. Williams, Australian Director-General of Civil Aviation. Its aim is to formulate international standards for flight safety in the South Pacific region. — *The Accident Investigation Division (AID)* of PICAO opened its second annual session on February 4th, in Montreal. Included on the agenda was the question of the establishment of standardised *regulations for investigating aircraft accidents and the publication by PICAO of relative findings*. —

FORTHCOMING EVENTS

● An *International Air Exhibition* will be held in the Halle du Cinquantenaire, *Brussels*, from July 4th to 20th, 1947. To mark this occasion, the *Royal Aero Club of Belgium* will hold an *International Flying Meeting* on July 6th.

AIR TRANSPORTATION

● *North Atlantic: Pan American Airways*, which was recently authorised by the CAB to operate to Naples and Athens, opened a once-weekly New York-Gander-Shannon-London-Ankara service on January 31st. The London-Ankara leg (2,189 miles) is flown non-stop in 8 ½ hours. — CAB have authorised the Norwegian carrier, *Det Norske Luftfartselskap* (DNL) to carry passengers, freight and mail from Oslo and Stavanger to New York and Chicago via Great Britain, Ireland, Iceland, The Azores, Labrador, Newfoundland and Quebec. This decision shows that CAB is not prepared to grant *Scandinavian Airlines System* permission to operate to the USA because SAS possesses no legal personality of its own. — *Trans World Airline* inaugurated a once-weekly return cargo service from Washington to Lydda, Palestine, via its established trans-Atlantic route.

● *South Atlantic:* The French Government is at present negotiating with Portugal for intermediate landing rights at Lisbon on the *Air France* Paris-Casablanca-Dakar-South America route. *Pan American Airways* has obtained approval of the South African authorities to extend its New York-The Azores-Dakar-Monrovia-Accra-Leopoldville service to Johannesburg on a special flight basis as from February; this is, of course, pending conclusion of the air agreement now in negotiation. — According to the Managing-Director of *British South American Airways*, Air Vice-Marshal D.C.T. Bennett, this carrier will not fly its new South American service from London to Buenos Aires by the previous route, but by way of the Azores, Bermuda, Jamaica, Lima and Santiago de Chile. The most important intermediate airports are to be fitted with modern radar navigational aids. The service is to be opened in the middle of March with Avro "Tudor I's" and from August "Tudor II's" will be introduced.

● On January 22nd, the *Trans World Airline wage dispute* was settled by an arbitration panel which fixed the following *increased salaries:* international service: first pilots, $ 925 — $ 1,000 ($ 100 more); co-pilots, $ 290 — $ 520 ($ 60 more, plus $ 50 if qualified in celestial navigation). Domestic services: first pilots, $ 60 more; co-pilots, $ 40 more.

● The Foreign Commerce Committees of the US Senate and House of Representatives are at present conducting hearings on current *US air transportation safety measures*. Theodore P. Wright, Civil Aeronautics Administrator, pointed out that CAA had requested a grant of $ 113,890,000 for its 1947-48 fiscal year, but that this figure had been cut to $ 92,271,000.

● On January 28th, the *Air Safety Board*, established by the British Ministry of Civil Aviation, met in London. A suggestion by the British Air Line Pilots' Association (BALPA) to reduce the *all-up weight of Douglas DC-3's* from 28,000 lbs. to 26,500 lbs. was not adopted as there was no evidence that previous accidents to Douglas DC-3's were due to overloading.

● On February 3rd, the US Civil Aeronautics Administration decreed that all foreign-owned aircraft of American manufacture conform to American all-up weight regulations when flying into the USA.

● The British Ministry of Civil Aviation has closed London Airport (ex-Heathrow) to non-scheduled carriers. Exceptions are made in the case of large aircraft on the condition that they are fitted with adequate blind-landing equipment.

AIRLINE PERSONALITIES

● The US Civil Aeronautics Administration has appointed *H. Arthur Hook* as *Assistant Administrator for Airports*.

● *American Airlines* has appointed *Maulsby Forrest* and *C. W. Jacob* as *Vice-Presidents*.

● *Terrell C. Drinkwater* has replaced William A. Coulter as *President of Western Air Lines*.

MILITARY AVIATION

● The American *budget proposals* for the 1947/48 fiscal year, to be presented on July 1st for approval, allocate $ 850,000,000 for the *US Army Air Forces*, permitting 55 groups are to be kept at 80 percent full strength and 15 groups on a skeleton basis. The present strength of 7,000 regular officers is being increased during the year by a further 11,000.

● The war-time RAF airfields at Valley, near Holyhead (Angelsey), and Little Snoring, near Norwich, are to be expanded as permanent establishments. $ 1,500,000 is to be expended on the latter base.

MILITARY PERSONALITIES

● *Admiral Marc A. Mitscher*, Commander of US Atlantic Fleet, commander during the war of substantial aircraft carrier units in the Pacific, and one of the most notable exponents of naval aviation, died on February 3rd, 1947, aged 60.

● *Air Marshal Sir Norman H. Bottomley* has replaced Air Chief-Marshal Sir Arthur S. Barratt as *Inspector-General of the RAF*.

● *Group Captain E. M. Donaldson* has been awarded the *Britannia Challenge Trophy* by the Royal Aero Club of Great Britain for establishing the world speed record (991 km/h) with a Gloster "Meteor IV" twin-jet fighter in September, 1946.

● *Lieutenant-Colonel Dr. Max Waibel* has been appointed *Military and Air Attaché to the Swiss Legation in Washington, D.C.*

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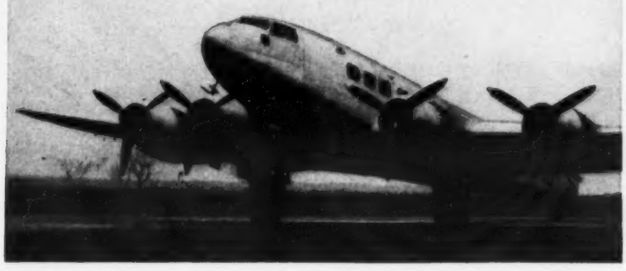

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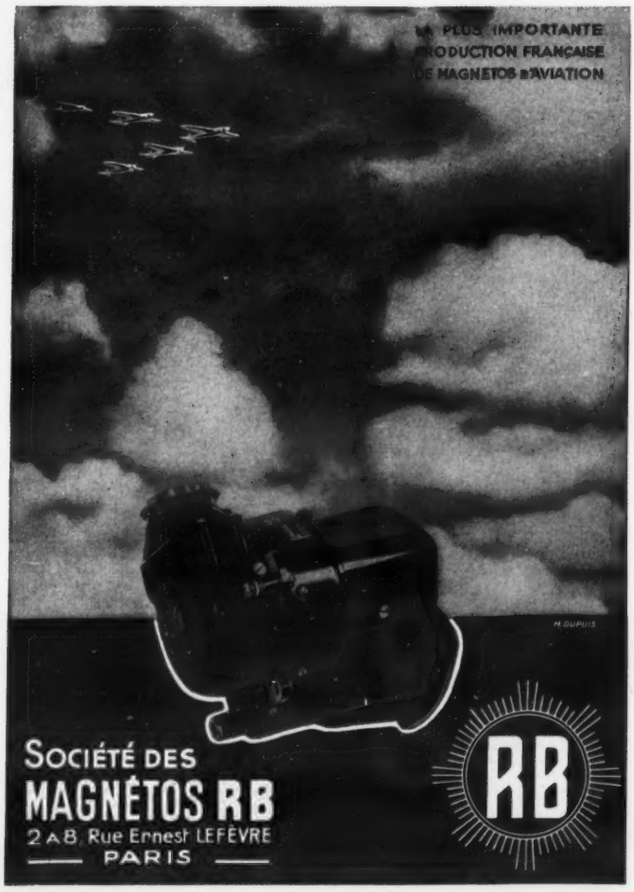

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